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THE CASTING OF A PARSONS MANGANESE BRONZE PROPELLER WHEEL.

NOTABLE ACHIEVEMENT BY AN AMERICAN FOUNDRY.

The casual visitor to the plant of Wm. Cramp & Sons Ship and Engine Building Company, at Philadelphia, Pa., on the morning of September 29, would have noticed nothing out of the ordinary routine, yet preparations were steadily going on for the casting of the largest all bronze casting made for the steamship *Celia*, weighing approximately 25,000 pounds and measuring 17 feet 6 inches in diameter. It was designed to replace a cast iron wheel now in use on the vessel, which was built about six years ago. The general practice in the manufacture of these

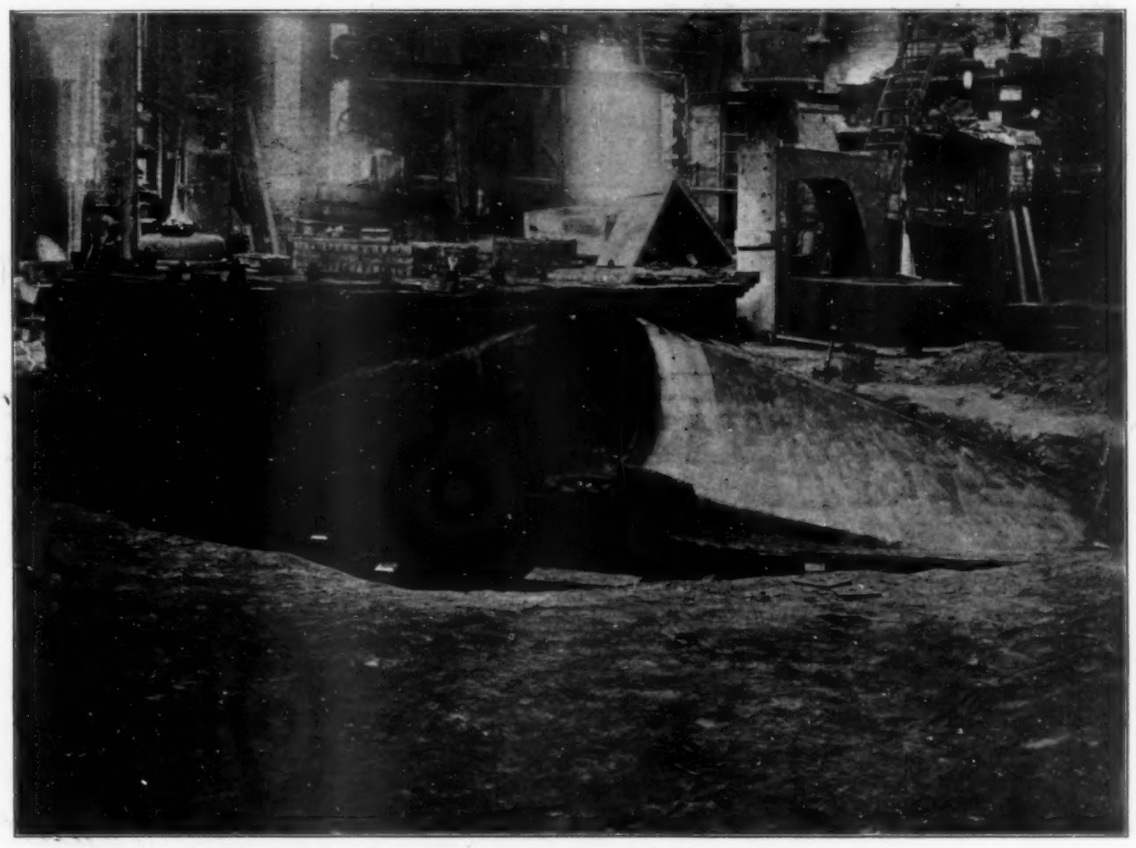


FIG. 1. THE MOULD.
This picture shows the mould of the fourth blade of the propeller not yet closed.

propeller wheel ever made in the United States. The close of the day was to witness the successful pouring of the most ambitious undertaking in the non-ferrous metal line ever attempted at the Philadelphia works.

The wheel in question was an all manganese bronze wheels is to cast the hub or central portion of cast iron and then to bolt on the blades of brass or bronze, as the case might be. Wheels made in this way have given considerable trouble, owing to the corrosion caused by galvanic action set up between the dissimiliar metals. In

order to overcome this annoying and expensive difficulty it was decided to cast this wheel of all bronze in one piece. We believe that this particular wheel was the largest ever made in this country, at any rate of all bronze. Monel metal wheels have been made all in one piece, but none of this metal has been cast as large and heavy as this one. The casting of a Monel metal wheel was described in THE METAL INDUSTRY, January, 1909.

The wheel so successfully cast on September 29, and shown in cut, Fig. 4, was produced in the brass foundry of the Cramp works under the superintendency of George C. Matlack, who is in charge of the steel, iron and brass foundries of the works. Mr. Matlack succeeded Benj. H. Cramp, retired, and has had long years of experience in foundry practice. The practical work of making the mould and casting the wheel was done under the direction of Foreman Wm. A. Taylor, an expert foundryman of wide experience.

FIG. 2. POURING THE WHEEL.
This picture shows the 23,000 pounds of Parsons' Manganese Bronze being poured into the mould.

THE MOULD.

The mould for this enormous wheel, a cut of which we show in Fig. 1, occupied the attention of two moulders and two helpers for a week. It was built up in sections and had four copes. There are four blades on the wheel and the space between the mould of the blades was filled in with brick. The outside of the mould was also built up of brick, and as shown in Fig. 1, was encased in sheet iron and reinforced with straps bolted in place. This latter was done to guard against a possible rupture, resulting in a "run out," which sometimes happens in a mould of this size and character, as the pressure exerted by such a mass of molten metal is enormous.

THE FEEDER BOX AND GATE.

The "gate" by which the wheel was poured was 5 by 6 inches in diameter, and about 6 feet long. It ran down through the mould and came up under the hub, thus making what is known as an under poured "horn" gate. The "sink head" or riser, and by the way the only riser on the wheel, was of the same diameter as the hub and 22 inches long; in fact, it was really an extension of the hub itself, shown in the cut, Fig. 4. This is finally cut off and is designed to take up the shrinkage of the metal and thus ensure sound metal in the hub itself.

A runner or overflow box extended from the side of the sink head, opening out to the edge of the mould, and allowed the surplus metal, after the mould was filled, to run out into the sand bed prepared for it and divided into pigs. This is shown in cut, Fig. 3. The feed or pouring box was placed at one side of the mould, and a runner box was built from it to the gate opening. The feed box at time of pouring was full, and thus pressure was produced to keep the metal flowing steadily and evenly into the gate and thence to the casting.

THE METAL.

The metal of which the wheel was cast was the well known Parsons Manganese Bronze, for the manufacture of which the Cramp concern owns the exclusive right in this country. The enormous mass of metal required for the wheel was melted under the personal direction of N.

H. Schwenk, the metallurgist and chemist of the works. The charges were made up of ingots of Parsons Manganese Bronze made from spelter produced on the premises. It is a matter of note that no scrap other than their own make is used at the Cramp plant. All of their mixtures are made from practically new metal, with a minimum amount of scrap. All the spelter used by the concern is made in their own furnaces by means of a special distillation process under the supervision of Mr. Schwenk. The material of which the spelter is made is the dross and skimmings, etc., from the galvanizing plant operated by the company.

The furnaces employed for the melting and mixing of the metal for the 25,000 pound wheel were of the old fashioned pit type and were located in three different parts of the works. There were used 59 No. 150 crucibles and 16 No. 225, so that close to 30,000 pounds of metal was melted at one time. The utmost care was taken to have all the pots as uniform in heat as possible. Tacked on the wall by each set of fires was a placard stating "That no pot should be filled fuller than within two inches of the top." The order had gone forth that no pot should smoke, so that when the time came to pour the metal no difference in temperature between each pot could be observed by the eye.

The entire charge for the wheel was finally poured into one large ladle and the time consumed in transfering the metal from crucible to ladle was 34 minutes. At the signal of Foreman Taylor the pots of molten metal were drawn out of the fires and carried from the three directions to be dumped into the enormous caldron waiting in a pit to receive it. It was a remarkable sight to see such a large amount of metal handled with the regularity and precision of clockwork.

POURING THE WHEEL.

After the last pot had been poured into the ladle, the surface of the metal was skimmed free of charcoal, the only covering used, and dross, and by the way there was a surprisingly small amount of this. The ladle was then hooked on to the chain of the 20-ton overhead electric crane and swung into position in front of the pouring box of the mould. Our photograph, Fig. 2, shows in a somewhat imperfect manner the pouring of the wheel.

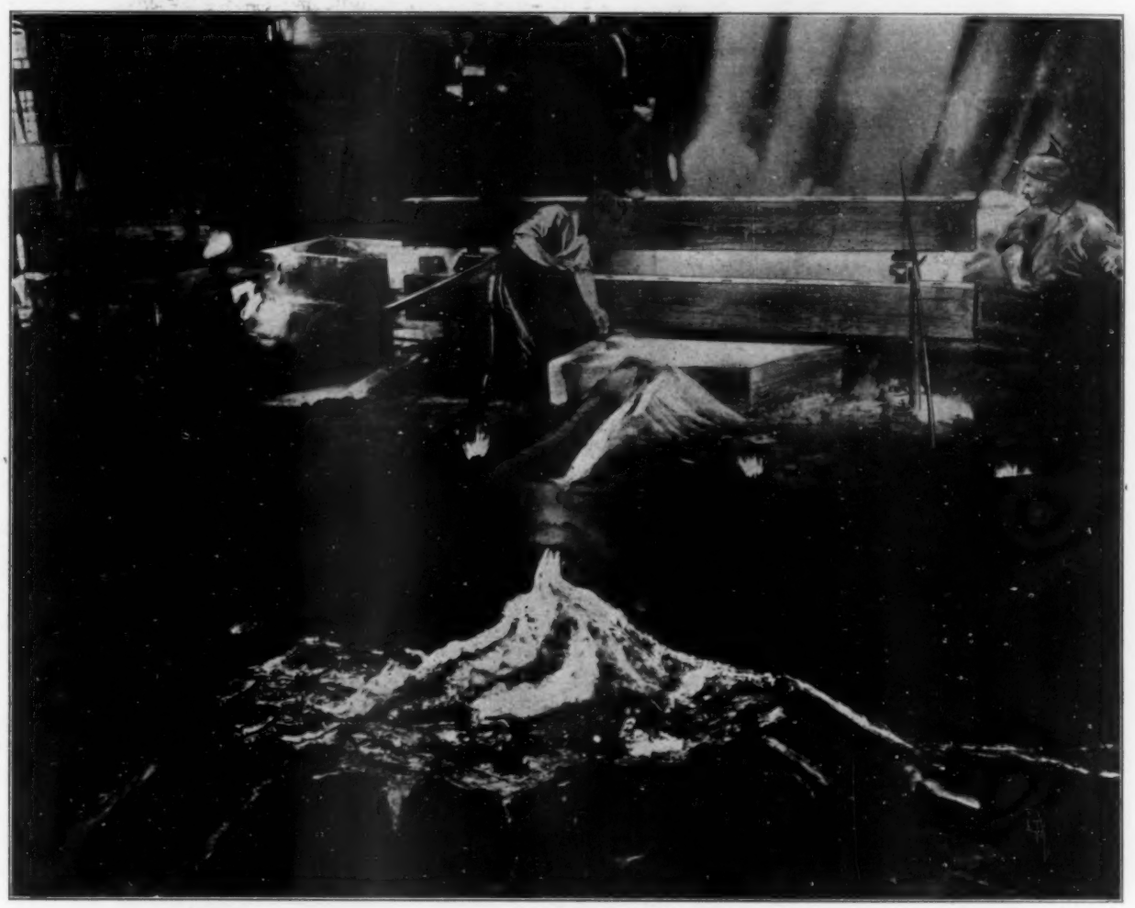


FIG. 3. THE OVERFLOW.

The successful end of the pour; the surplus metal flowing out of the mould into the sand pit.

Slowly the giant piece of machinery brought the glowing mass of metal into place, until the ladle's lip was just over the edge of the pouring trough. Three men grasped the tilting gear and the metal was rapidly poured out into the trough. Barely three and one-half minutes had passed when the metal rushed out of the overflow box and into the sand bed as shown. The giant wheel had been poured and no mishap had occurred. Every one breathed easier and congratulations were in order. Of course the real outcome of the pour could not be known for at least four days, until the casting could be taken from the mould, but a glance at Fig. 4 will show the justification of the faith of those who said the casting was "good" after the pour.

DIMENSIONS OF THE WHEEL.

It may be interesting to note some of the principal dimensions of the propeller. The diameter is 17 feet 6 inches, with a mean pitch of 18 feet. The hub is 3 feet thick or deep, with an outside diameter of 33 inches, and a bore of 15⅜ inches at one end and 12¾ inches at the other. There are four blades with a length of 7.9 feet, the cross-section of the blade is 6¾ feet, and the greatest width is 46 inches. The expanded area of the wheel is 100.4 square feet, and the projected area 83.3 square feet. It is estimated that the finished wheel will weigh 20,000 pounds.

water to a high degree, in fact better than any metal so far discovered. For use in the manufacture of machinery used in mining and chemical operations, manganese bronze is indispensable, as it resists the attacks of acids and various chemicals. The color of manganese bronze is most pleasing to the eye, and when polished it retains its brilliancy for an indefinite period.

The toughness of the metal is best illustrated by the fact that a dynamite company not long ago had occasion to break up some large pieces of Parsons Manganese Bronze which were the result of sprue-gates and overflow, etc., of some large casting. The dynamiters reported that it was the toughest job they ever handled, and that the metal had the tenacity of mild steel and it was extremely hard to fracture it even at a "black heat," which is the state in which the metal is weakest. Considerable has been published in THE METAL INDUSTRY regarding manganese bronzes, the most important of the recent articles appearing in January and July, 1909.

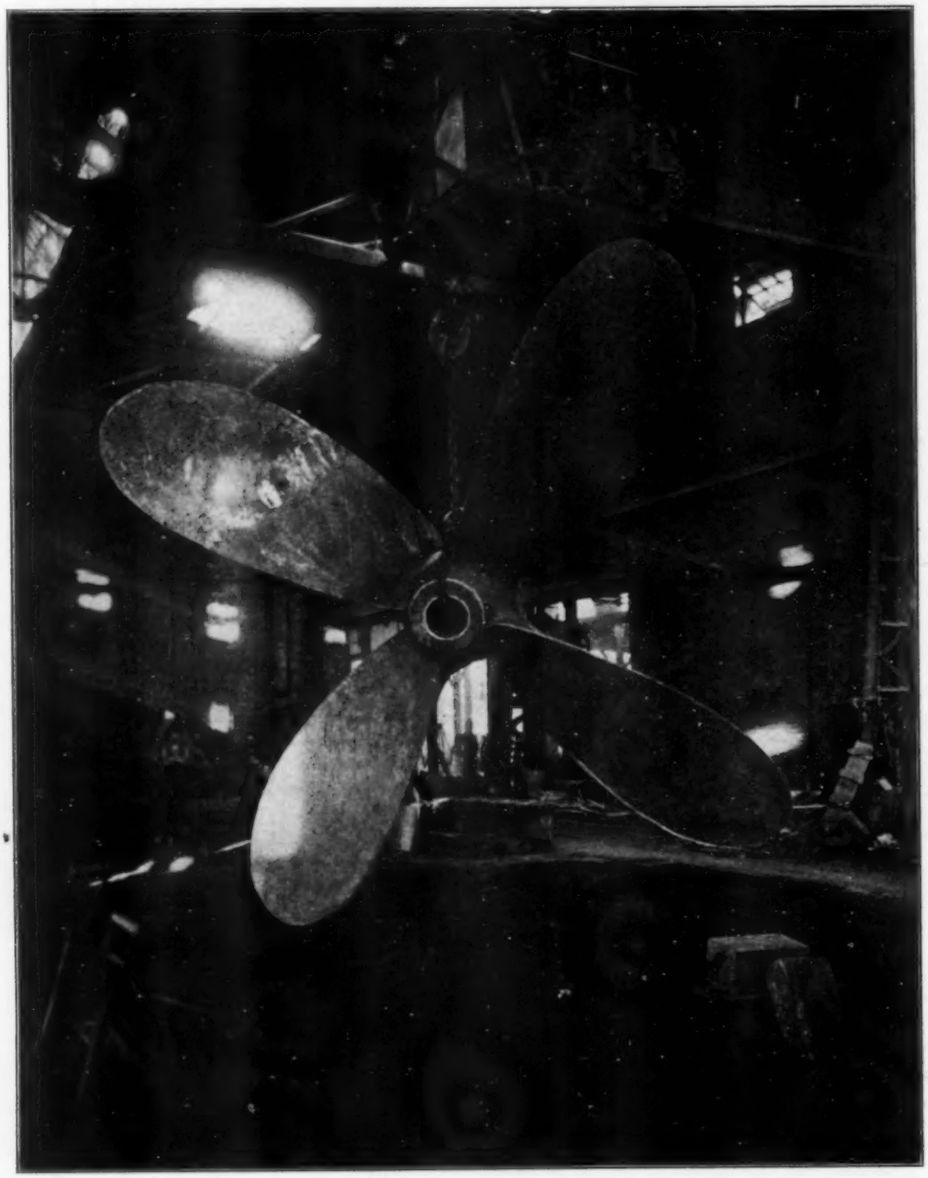


FIG. 4. THE 10-TON PARSONS MANGANESE BRONZE PROPELLER WHEEL.
A successful finish of a difficult job.

SOME CHARACTERISTICS OF PARSONS MANGANESE BRONZE.

The most important qualities of this metal are its great tensile strength, high elastic limit and its resistance to corrosion. The latter property makes the metal particularly adaptable for the manufacture of all sorts of marine purposes, such as ship sheathing, nails, bolts, rods, shafts and propeller wheels. It withstands the action of sea-

SOME COMMON DEFECTS OCCURRING IN ALLOYS*

By Cecil H. Desch,† D.Sc., Ph.D.

The study of what may be called the diseases of the non-ferrous metals and alloys is still in a very backward condition as compared with that of iron and steel. Several causes have contributed to produce this effect. In the first place, the number of industrial metals and alloys is so large, and their characteristic properties so diverse, that conclusions arrived at from a study of one group prove to be of little or no value when an attempt is made to apply them to another. For example, to take only two closely related groups, the results obtained from experiments on the heat-treatment of the brasses would prove useless or misleading if applied to gun-metals. This fact is, of course, obvious to any one acquainted with the equilibrium diagrams of these alloys, but these diagrams, which for the metallographer present such a wealth of information in a compact form, convey little to the practical metallurgist who is not versed in physical chemistry.

The manufacturer of alloys who is called on to produce a new alloy for some special purpose, or to modify the properties of some familiar mixture in order to meet new requirements, has generally to grope in the dark. Variations in the mode of preparation frequently do not lead to the expected result, and fresh difficulties crop up with the introduction of even small quantities of a new ingredient, which are not to be accounted for by the known behavior of that ingredient when alloyed with other metals. The only method of arriving at a successful result is, therefore, that of repeated trial, frequently involving, as the manufacturer knows only too well, the spoiling of many batches of metal. Even after the required result has been apparently attained, subsequent charges of the alloy are apt to develop mysterious defects, although they were believed to be prepared by exactly the same method.

Moreover, the manufacturer's difficulties are not over when he has delivered his product in an apparently satisfactory condition. He may, and frequently does, hear that the alloy has failed in practice after having passed the specified tests, and the failure is generally attributed to the defective quality of the alloy. This is, of course, sometimes the case, latent defects having revealed themselves under the conditions of practice; but it also happens very frequently that a perfectly satisfactory alloy fails through being subjected to entirely unreasonable heat-treatment or mechanical straining in the course of being fitted for use. Such treatment is applied in ignorance of the effect likely to be produced, and considering the care that is taken in handling steel, it is remarkable that non-ferrous alloys are often treated as if they were inert material, which might be ill-treated without suffering any injury.

For instance, while no user of metals would quench a steel from a high temperature, or submit it to prolonged annealing, without reference to the purpose for which it was required, it is not an uncommon experience to find bronzes of a special character treated in such a way. Here, again, a knowledge of the equilibrium diagram indicates what is to be done and what is to be avoided. It may be said that most of the users of steel are quite innocent of any knowledge of the highly complex conditions of equilibrium in the alloys of iron and carbon, and this is no doubt true; but the experts who have chiefly developed our knowledge of the properties of the steel have made full use of metallographic methods, and it has been found possible to put their conclusions into a more or less simple form for each variety of steel, the user of which thus obtains the results of tedious and complex researches in the shape of simple practical rules. The same course must be followed in respect to other alloys. We cannot expect every maker and user of non-ferrous alloys to become familiar with the intricacies of the equilibrium diagram; but it is important that a very thorough study should be made, by those competent to undertake it, of the effect of heat and mechanical treatment on each important group of alloys, and of the effect of smaller quantities of other elements on them, due regard being paid to the constitution of the alloys as revealed by the metallographic study. * * *

* * * * The following classification of some of the common defects observed in alloys is by no means exhaustive, and is only intended as a preliminary review, to serve as a basis of discussion. The Institute of Metals has recently undertaken the formation of a museum illustrating the "diseases" of metals, and it is to be hoped that members who meet, in the course of their experience, with interesting instances of metal or alloys which have developed marked defects in use, or which have been spoiled by improper treatment, will send specimens for the museum, accompanied by as full a statement as possible of the exact conditions under which they were obtained. In this way a most valuable mass of information should be accumulated, on which it would be possible, if not to base generalizations directly, at least to decide on profitable lines of investigation. The interchange of experience relative to such questions as these is already common in the iron and steel industry, and has proved of inestimable value, and it is to be hoped that the meetings of this Institute may facilitate and encourage a similar practice in the industry of the non-ferrous metals, which has hitherto been shrouded in an atmosphere of considerable mystery.

One cause of alloys being found defective in practice is here omitted, namely, the use of an alloy of unsuitable composition. It is assumed that the intended composition is a proper one for the purpose for which the alloy is to be used. This limitation is necessary in order to avoid entering a much wider field than could be dealt with in a short paper. The first class of defects includes those which are present in the original casting, and may be classified as (1) sponginess, due to the enclosure of gas; (2) brittleness or weakness, due to the presence of (a) oxides or other drossy matter; (b) intercrystalline metal or eutectic alloy.

1. Sponginess is caused by gases, dissolved in the molten metal or alloy, being released at the moment of solidification. Unlike other liquids, molten metals dissolve more gas as the temperature rises, so that the more the metal or alloy is overheated before casting, the more gas it will dissolve; and, as such solutions easily remain supersaturated, an overheated metal will usually contain more gas at the moment of pouring than one that has only been heated to the proper casting temperature. This defect may, of course, be corrected by re-melting and pouring at the proper tem-

* From a paper read at Glasgow meeting of Institute of Metals, September, 21-23, 1910.

† Graham Young, lecturer in metallurgical chemistry in the University of Glasgow.

perature. Blisters in rolled sheet metals are generally due to this cause.

Gas-pores are frequently microscopic, and are only to be detected in a prepared section, which is preferably examined without etching.

2. (a) The presence of oxides or dross may be due to insufficient care in pouring, allowing dross to be carried into the mould along with the metal, or to overheating, causing burning, especially in the case of zinc alloys. The oxides of different metals differ widely in their tendency to separate from the alloy and rise to the surface. Copper oxide is the only one which dissolves in the liquid to any appreciable extent, hence its effect on an alloy is not that of a dross, but falls under (2 b). Zinc oxide is friable, and remains entangled very easily, which is the reason why a deoxidizer is added in casting brass and similar mixtures. Tin oxide forms well-developed crystals, which are hard and brittle, and give rise to planes of weakness. Aluminum oxide is difficult to eliminate, and has a remarkable tendency to form thin pellicles, surrounding drops of the liquid, and these drops are thus prevented from uniting. Pure molten aluminum always appears to be enclosed by a thin skin, and this behavior is also exhibited by its alloys. The oxide of magnesium resembles that of zinc, and its presence in nickel often causes cracking when the metal is rolled, if magnesium has been used to deoxidize. On the other hand, the three remaining deoxidizers of importance—manganese, phosphorus and silicon—form oxides which are readily eliminated in the form of slag, on account of their great reactivity, which enables them to combine with some of the constituents of either the crucible or the flux, to form fusible compounds. Brittleness due to the enclosure of oxides is thus prevented by using one of the last three deoxidizing agents in casting. Alloys of copper and nickel, for instance, which often crack in rolling owing to the presence of oxide, are perfectly malleable if deoxidized with cupro-manganese.

The detection of oxides by means of the microscope requires care, as the exceedingly friable nature of these substances causes them to break out of the surface during polishing if emery paper is used, leaving cavities in the place of the original oxide particles.

(b) The second source of brittleness named above is the presence of thin layers of a eutectic alloy between the crystals, producing discontinuity. This occurs when an impurity is present which forms a fusible eutectic with the other constituents. A characteristic example is seen in the effect of bismuth on copper or alloys of copper, the eutectic (which in this case differs little in composition from pure bismuth) forming highly brittle layers between the crystals of copper, which are therefore easily separated by shock. A very minute quantity of antimony also renders brass cold-short. The remarkable brittleness produced by the addition of mere traces of lead or bismuth to gold, observed by Roberts-Austen, is accounted for in the same way.

The microscope is of great assistance in studying such cases as these, although skill is required to render minute quantities of eutectic visible in a soft tough metal, such as copper. When the proportion of eutectic is small, it usually appears under the microscope as a single substance, owing to segregation of the constituents. The brittleness caused by the presence of intercrystalline matter may not show itself at all temperatures, but may only become perceptible when the alloy is subjected to stress at a high temperature. This is of particular importance in the case of fire-box stays, and also in that of the bronzes used for valves and other steam fittings. Lead is frequently added to such bronzes in order to increase the ease with which they are worked, but the amount of lead which can be held in safety by bronzes is very small, and any excess above the limit causes rottenness at the temperature of the steam.

An impurity which enters into the alloy in the form of a solid solution, instead of forming a eutectic, is not visible on microscopical examination. Such an impurity does not produce brittleness if only present in small proportion, but may nevertheless have a fatal effect on certain physical properties, especially on the electrical conductivity.

3. DEFECTS DUE TO INEQUALITIES OF COMPOSITION.

These may be due to (a) imperfect mixing of the ingredients; (b) separation by gravity during solidification; (c) segregation in the mould.

(a) When there is a difficulty in mixing the ingredients uniformly, the usual cause is their difference of specific gravity, a light metal, such as aluminum, having a marked tendency to float, while a heavy one, such as lead, sinks. In addition to this, the property of certain metals, particularly aluminum, of becoming enclosed in a film of oxide as soon as molten, is a difficulty in the way of obtaining a uniform mixture. There is also the case of metals which do not mix when molten, but behave like oil and water. If sufficiently stirred they may be brought into the form of an emulsion, but the extent to which separation into two layers takes places again will depend on the rate of cooling. Lead only dissolves to a very small extent in most bronzes, and if allowed to cool slowly will collect in the lower part of the ingot, which thus contains more lead than the upper part.

In a few instances an emulsion of different metals is deliberately prepared, as in the plastic bronzes used for bearings. These consist of a bronze meshwork holding lead in the cavities. The quantity of lead far exceeds that which can be held in solution in the liquid state, and unless casting is carried on under the proper conditions, the emulsion tends to separate, and lead becomes concentrated in the lower part of the casting.

(b) The most familiar example of the separation of constituents by gravity during solidification is that of the alloys of tin and antimony, or bearing-metal mixtures containing those metals. The cubes of the tin-antimony compound are the first to crystallize, and tend to float up to the surface, becoming almost entirely concentrated in the upper part of the casting. This is avoided by chilling rapidly.

(c) The segregation of impurities in steel ingots has been the object of repeated study. The only case which has been thoroughly investigated in the non-ferrous alloys is that of gold and silver bullion. In general it may be said that those impurities which form fusible eutectics, such as lead and bismuth, in the bronzes, will accumulate in the central part of the ingot, thus producing unsoundness in large castings, even when the proportion of impurity, calculated on the whole mass, is not excessive.

Hard phosphor-bronzes are often defective through lack of uniformity in their composition.

4. EXCESSIVELY COARSE STRUCTURE, DUE TO CASTING AT TOO HIGH A TEMPERATURE.

This defect is dealt with in Mr. Primrose's paper for the case of gun-metal. As the strength of an alloy

depends on the degree of interlocking of neighboring crystal grains as well as on their size, the dependence of strength on casting temperatures and degree of chilling is of a complex kind. The conditions governing crystallization demand much further investigation. A few alloys, such as the β-solid solutions in the copper-zinc series rich in zinc, have an extraordinary tendency to form large crystals having little mutual adhesion.

5. DEFECTS DUE TO WRONG THERMAL TREATMENT.

(a) Quenching from a high temperature. Leaving aside chilling cracks, which fall into another class, the principal effect of erroneous treatment in this direction is the production of large crystal grains (coarse structure) in alloys in general, and in most of the bronzes, of a hard, brittle constituent in a more or less unstable state. For example, alloys of the Muntz metal class, and certain of the tin and aluminum bronzes, which normally contain two micrographic constituents, are changed by quenching from temperatures above a certain limit into a single solid solution. Such alloys are harder and stronger under ordinary loading than the normal alloys, but at the same time they are more brittle, and less resistant to shock. The coarse fracture and the peculiar "crinkled" surface of tensile test-pieces of alloys treated in this way are very characteristic. Occasionally such quenching is intentionally resorted to, in order to increase the strength at the cost of some sacrifice of ductility, but the treatment is not without its danger, and error in the quenching conditions may render the alloy brittle.

(b) Heating at too high a temperature or for too long a time during annealing. The dangerous coarseness of grain produced by such treatment is well known. Reference may be made to the memoirs already cited.

(c) "Burning" in the case of alloys of copper and zinc. There are differences of opinion as to the cause of this defect occurring at high temperature. I am inclined to regard the burning temperature as that at which the zinc held in solid solution has a certain appreciable vapor pressure.

(d) Unequal thermal treatment of different parts of the same casting or forging, producing differences of structure and of size of grain.

All the defects enumerated under (4) may be detected by means of the microscope, provided that the constitution of the alloys is known. Deviations from the size of crystal grain found best for any special purpose may be measured and recorded.

6. DEFECTS DUE TO MOLECULAR CHANGE, OTHER THAN THAT PRODUCED BY MECHANICAL STRESS.

Some metals undergo allotropic changes, involving a complete alteration of properties, at definite temperatures. The most striking instance is that of tin, which is metastable below 18 degs. and may pass spontaneously into a gray powdery modification, devoid of mechanical strength at lower temperatures. While gray tin is only a laboratory curiosity in this country, the "tin plague" is the source of serious inconvenience and loss in such cold countries as Russia.

It appears, moreover, that tin is capable of undergoing another change at the temperature of a warm room, being transformed in course of time into coarse, loosely adherent crystals. Like the tin plague, this disease may be caused to spread through a mass of ordinary tin by inoculation.

The spontaneous disintegration of alloys has been described very frequently. Many of the alloys of aluminum with other metals fall to powder after a time, while an alloy of 80 per cent. aluminum and 20 per cent. tin breaks up into coarse crystals. It is doubtful whether this behavior is really an instance of molecular change. It would be interesting to observe the behavior of alloys prepared on the small scale from pure materials, and with special precautions to avoid contamination with carbon, silicon or gases. The importance of this condition is seen on comparing the case of the alloys of copper and manganese, which have been described as disintegrating spontaneously. When prepared with pure materials, however, they are perfectly stable, and the disintegration is entirely due to the presence of non-metallic impurities.

Some solid solutions undergo a molecular change at a critical temperature in such a way that only a few of their properties exhibit any alteration, as in the remarkable magnetic bronzes described in Mr. Ross's paper. So far as is known at present, such transformations are not accompanied by any change of crystalline form, although this may only mean that our methods of discrimination are not sufficiently delicate. Until lately, it was impossible to distinguish α, β and γ-iron microscopically, but the beautiful work of Rosenhain and Humfrey has shown that the application of stress reveals the crystallographic differences with wonderful clearness. It is quite possible that the great and sudden diminution of strength which most bronzes and other copper alloys exhibit at moderately high temperatures may be due to some such molecular transformation, and an application of this method might reveal differences of crystalline structure which have hitherto passed unnoticed.

A great variety of defects are due to mechanical rather than to chemical causes. These include:

7. SHRINKAGE CRACKS,

which may be due to the unsuitable arrangement of the mould, to a wrong temperature of casting, or to great brittleness of the alloy at a temperature just below that of solidification. The latter condition is the cause of the great tendency of aluminum-zinc castings to crack during cooling.

8. DEFECTS DUE TO MOLECULAR CHANGE PRODUCED BY MECHANICAL DEFORMATION. (a) THE BRITTLENESS OF COLD-WORKED METALS.

The cause of the hardness of cold-worked metals and alloys has been shown by Dr. Beilby to be the formation of an amorphous, unstable modification. This gives rise to a number of defects, a few of which may be enumerated:

(i.) "Season-cracks" in brass and other alloys, showing themselves some time after rolling. In this case the outer layers are in a more highly strained condition, and are more laregly converted into amorphous material, than the inner portions, and cracks develop on the surface, spreading inwards.

(ii.) "Fire-cracks," which differ from the foregoing in appearing only during the annealing process. The reconversion of the amorphous into the crystalline modification is accompanied by a change of volume which may cause cracking if the external and internal layers differ greatly in their state of strain. The most usual course of fire-cracks is therefore the application of insufficiently heavy "pinches" in breaking down, resulting in the formation of a severely

strained outer layer, while the internal portions are only slightly affected. It is said that fire-cracks never appear in pure metals, while they are very characteristic of solid solutions. German silver is particularly liable to this defect.

It is remarkable that the state of strain referred to may be partly removed by shock. Thus, in order to prevent the development of fire-cracks, brass and bronze rods are "sprung" by bending sharply, coils of wire are "whipped," and heavier objects are "belted" with a wooden mallet. The removal of strain effected in this way recalls the effect of shock on magnetized steel, and is no doubt connected with the re-orientation of the molecules, as studied by Ewing.

(iii.) When there is no inequality of strain, but the material has been very severely worked, as in articles spun from sheet, the crystals are very largely converted into the amorphous modification, and the tendency to recrystallize may be so pronounced as to set in spontaneously, or apparently so, especially if assisted by vibration. Some remarkable examples of the recrystallization of spun brass have been studied lately by Cohen, who has shown that a piece of strained metal may be caused to crystallize by "inoculating" it with particles of crystalline metal. The "strain-disease" (Forcierkrankheit) is therefore, like the tin plague, contagious. This is, of course, in accordance with the physico-chemical view that the hardened material is a metastable modification, and therefore tends to be transformed in contact with the stable form.

(b) Chilling-cracks, produced when metals are suddenly quenched. These cracks are also due to differences in strain, produced in this case by the rapid cooling, and consequent contraction, of the outer layers.

(c) Cracking during hot-working. Most alloys show an increased brittleness at some characteristic temperature. Many bronzes have only a small range of temperature within which they may be safely worked. The connection between these temperatures and the constitution of the alloys has been very imperfectly investigated.

The recognition of conditions of strain in metals and alloys is best accomplished by means of physical tests, their microscopical study being a matter of great technical difficulty.

There remain a few defects which arise in the course of the use of alloys, and do not fall under one of the above heads:—

9. CORROSION.

The whole problem of the corrosion of alloys in the course of wear is very complex. Fortunately, a special committee of this Institute has been formed to collect data bearing on the subject, and to conduct further investigations, and it is therefore unnecessary to make further reference to the matter here. It may be permissible, however, in connection with what has been said under (7) to point to the differences of potential which exist between the strained (partly amorphous) and the crystalline modifications of the same metal or alloy as a factor which has so far hardly received sufficient attention.

10. EROSION.

The conditions which affect the liability of alloys to mechanical erosion also demand further study. A case of the greatest importance is that of the erosion of high-speed propellers by the action of eddies. Some remarkable specimens, now to be seen at the Japan-British Exhibition, showing patches near the middle of each blade eroded to a depth of as much as 1½-inches while the rest of the blade is quite smooth, illustrate the necessity for a thorough study of this question. It appears that certain bronzes are not liable to the defect—at least in the same degree; and it is very desirable that a relation should be established between the microscopic structure and the liability to erosion.

Other forms of erosion, produced by solid particles in suspension, also depend in a little explained manner on the internal structure of the alloy.

MAKING RUSSIAN SAMOVARS.

From United States Consul Hernando de Soto, Riga, Russia.

The manufacture of samovars in the government of Perm is the largest and most important home industry. There are about thirty small establishments devoted to this industry, each equipped with about a dozen turning lathes and a simple forge. The annual output of these workshops aggregate 40,000 samovars. The brass and covers are purchased at Moscow, the chimneys are forged and the bodies of the samovars are pressed out of sheet iron. These parts are soldered and turned, whereupon the brass handles and feet are fastened on, these latter parts being cast in special shops devoted to the casting of such accessories.

The wages paid to laborers per day are as follows: Turners, 2.50 to 3.50 rubles ($1.29 to $1.80); founders, 2 to 3 rubles ($1.03 to $1.54); solderers, pressers and smiths, 1 to 2 rubles ($0.51 to $1.03).

The samovar (self-boiler), the name under which the Russian "tea machine" is known, is a most practical apparatus, with a charcoal heater for keeping water boiling on the table for tea. Its form is very graceful, and it is an indispensable article in every Russian household. A medium size samovar retails, if of brass or nickeled, for about $5 to $8, including tray and small bowl. Silvered and engraved samovars command high prices, according to workmanship.

PRICE OF RADIUM.

In a recent lecture Sir William Ramsey stated that radium now costs $2,100,000 per ounce. This price is slightly less than that which Sir William said was the value of radium a little less than a year ago when, in an address at the laying of the cornerstone of the radium factory at Limehouse, he said that the value of the substance was $2,500,000 an ounce. That was at the rate of $90 per milligramme. Not so long previously radium had been obtainable for $2 a milligramme. Last January the price was said to be $3,000,000 an ounce.

A year ago there was about a quarter of a pound of radium in the whole world. The quantity now is not much greater. As a matter of fact, literally pure radium has been produced only within the last month. Sept. 5 last Mme. Curie told the Academy of Sciences in Paris that she had at last succeeded in obtaining pure radium.

A radium bank has existed for some time in Paris. Last January one was established in London, and similar institutions are to be founded in other great cities. These banks loan the precious substance to scientists and physicians. The cost is enormous. As much as $200 has been charged for the use of 100 milligrammes for a single day.

THE ELECTRIC EXTRACTION AND REFINING OF THE NON-FERROUS METALS

By John B. C. Kershaw.

(Concluded from September.)

Copper.

In the electrolytie separation of copper when a current of electricity is passed through a solution of copper sulphate, containing a little free acid, using electrodes of pure copper, the metal is dissolved at the positive pole or "anode," and is deposited at the negative pole or "cathode" in equal amount. What occurs in fact, is the transfer of the copper atom by atom (or in more scientific language "ion by ion")—across the intervening gap separating the two electrodes, the electric current being the agency which causes this transfer of atoms or "ions" from one pole to the other. If now the positive electrode of pure copper be withdrawn, and an electrode of impure copper containing silver, lead and other impurities be substituted, the same action occurs but with this important difference, the copper only is transported to the cathode; the other metals present as impurities either remain undissolved and collect as a sludge upon the face of the

TANK HOUSE AT THE ELMORE WORKS, LEEDS.

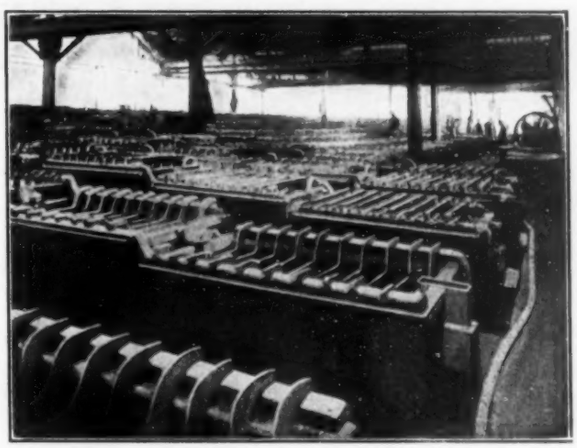
anode or upon the bottom of the cell, or they pass into solution, and accumulate there. The process becomes in fact a refining one, and by its means impure copper can be transformed into copper of the highest degree of purity.

The electrolytic process of copper refining would not, however, have shown such rapid growth during the last twenty years, or have attained its present position of importance, had there not been two other points in its favor. In the first place, the demand for a very pure copper for electrical cables and machinery produced a wide and ever-growing market for the chief product of the electrolytic refineries, and in the second place, the value of the "impurities" found in the sludge from the electrolytic vats or tanks in which the operation was carried out, in many cases more than covered the total cost of the process.

For, a very large proportion of the copper ores mined, contain small amounts of silver and gold, and these pass into the crude copper when the ore is smelted.

The electrolytic refining process is the most simple method for separating these valuable "impurities" from the red metal, and in the American refineries alone, the value of the gold and silver recovered from the "slimes" of the electrolytic copper vats, is estimated to amount to £4,000,000 ($20,000,000) per annum. If the refiners of the copper from the mines of the Western States were allowed to retain and sell the recovered gold and silver, they could afford to charge nothing for the refining process and would still gain large profits on the business; but it is now the custom for the mining companies to retain their interest in all the metals found in the slimes, and to pay simply a fair charge for the refining operation.

As regards the mechanical and enginering sides of the process, the chief changes that have occurred have been in the size and the construction of the cells or vats, and in the methods employed for making the anodes, and in charging and emptying the vats. At Pembrey, cylindrical earthenware vessels 33 ins. in height by 17 ins. in diameter, were originally employed; and each of these cells contained 10 electrodes—namely 4 cathodes and 6 anodes. One hundred of these earthenware cells were placed in series in terrace-wise fashion, so that circulation of the electrolyte could occur by the aid of syphons through the whole number. The electrodes of each vat were connected in parallel; the vats, in series. In the early days of the industry, the output of copper at Pembrey was only 15 cwts. per 24 hours, or about 250 tons per annum. The earthenware cells soon gave place to large rectangular wooden tanks, and the number of electrodes was increased from 10 to 40 or more per vat; while the weight of each anode plate was raised to 2 cwts. The number of vats worked in series was also greatly increased, since it was found to be more economical to use dynamos generating current at a comparatively high E. M. F. All the large refineries are now provided with traveling cranes in the vat houses, which

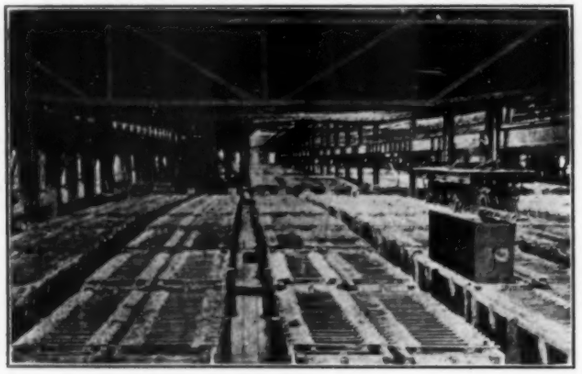


TANK HOUSE AT MESSRS. BOLTON'S WIDNES REFINERY.

are of immense superficial area (that at Perth Amboy, N. J., covers 120,000 sq. ft), and by aid of these, the anodes and cathodes for any one vat are picked up and charged in a most expeditious manner. Casting machines are also now being employed for making the anode plates, and here again a large saving in the costs of labor has been attained.

To illustrate the magnitude of some of the modern American refineries, the following details of that erected by the United Metals Selling Co. at Perth Amboy, N. J., may be given. This refinery, known as the Raritan Copper Works, has five 600 k. w. gener-

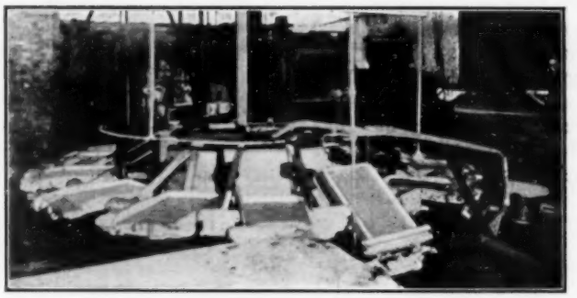
ating units (steam driven) each delivering 4,500 amperes at 135 volts. The vat house measures 600 ft. by 200 ft., and is equipped with 1,600 depositing vats, arranged in four parallel rows of 400 each. The vats measure 8 ft. in length, by 2 ft. wide, and 2 ft. deep, and contain when fully charged 22 anodes and 23 cathodes. Four traveling cranes run the full length of the building and serve each group of 400 vats. The daily output of the Raritan Refinery is between 150 and 200 tons, equivalent to 63,000 tons of refined copper per annum.



TANK HOUSE AT THE RARITAN COPPER REFINERY AT PERTH AMBOY, N. J.

A further illustration of the magnitude of the modern copper refineries is supplied by the fact, that in many of them, the value of the copper in the vats actually undergoing the refining process, amounts to between £300,000 and £500,000.

The total number of electrolytic refineries now operating is 37—located as follows: America, 11; Germany, 9; United Kingdom, 6; France, 4; Austria-Hungary, 2; Russia, 2; Japan, 2; Australia, 1. The eleven American refineries supply over 86 per cent. of the total output of refined copper, this extraordinary development being due to the fact that the copper ores mined in the Western States of America, contain large amounts of silver and gold, and are therefore the most suitable for the electrolytic refining process. The present annual output of electrolytic copper is estimated to amount to over 400,000 tons, and the following figures show the rapid growth of the industry during the last fifteen years:



WALKER & THUMS' ANODE CASTING MACHINE AT BALBACH REFINING CO., NEWARK, N. J.

Year.	Output.	Year.	Output.
1893.....	62,500 tons	1903.....	320,000 tons
1897.....	160,000 tons	1907.....	400,000 tons

References:

W. G. MacMillan..... { Treatise on Electrometallurgy. / Electric Smelting and Refining.

Bertram Blount..... Practical Electrochemistry.
J. B. C. Kershaw (1908).... Electrometallurgy.
Wilhelm Borchers ..... Elektrometallurgie.

THE PRODUCTION OF BROWN OR BRONZE BARBEDIENNE TONES BY IMMERSION.

By Charles H. Proctor.

I have been much interested in an article that was published in a technical journal some time ago, giving as the basis of this color golden sulphurett of antimony mixed with ammonia into the form of a paste and applied to the aritcle and allowed to dry thoroughly, then remove the excess of antimony with a soft brush and wax. This formula was copied and printed in an European journal and found its way back again to the United States as an original article. The wording was somewhat changed, but the method given was practically the same, and attracted my attention. The formula given in this article does produce a brownish, black tone, but it is not the true barbedienne tone, which is considerably lighter, with more of a metallic luster. The formation of the dark tone is probably due to the strong ammonia used, which, in the presence of a sulphide, will produce a brown to blackish tone upon brass, bronze or copper. This is noted when applications of potassium sulphide or barium sulphide are used with strong ammonia.

There are a number of methods used in producing brown tones that give far better results without the use of ammonia. The production of brown or barbedienne tones has always proved an interesting study to the colorer of metals because of their richly contrasting effect with brass relief upon the high lights of the articles so colored. The French colorers first produced what is known as the barbedienne bronze. How the color originated or why it was termed barbedienne I have been unable to determine; suffice it to say the color produced by the French operators are beautiful examples of the art of decoration of metals, not only upon solid bronze, but upon imitation bronze made from spelter, cast in molds and electroplated in the regular way. The true color of barbedienne bronze can only be produced upon the copper-tin alloys, as they render themselves very readily to the production of this finish, owing to the peculiar color of the bronze itself.

The color can be produced but not with so rich a tone upon brass, either plated or solid; the extrusion mixture used extensively in architectural bronze work gives good results, and cast articles made from the low brass mixtures, also sheet metal goods of the same composition give good results, but the tone is slightly redder than the color produced upon the tin-bronze alloys or brass. A hot solution consisting of

Yellow or Red Sulphurett of Antimony..2 ozs.
Caustic Soda .....8 ozs.
Water .....1 gal.

gives good results, providing the proper manipulations are followed, which consist of cleansing the articles in the regular manner, scratch brushing wet, using

a little pumice stone mixed with water and applied to the articles when brushing. To produce a deadened effect similar to brush brass a rewashing in clean water and an immersion in the hot sulphurett of antimony solution for ten to fifteen seconds, rewashing in cold water, then an immersion in boiling water for a number of seconds. The articles are then dried out in fine maple or boxwood sawdust, scratch brushed dry, using a very soft or worn brass wire brush; the crimped variety gives excellent results. After the dry brushing the articles are reimmersed in a cold solution of one-half the proportions given. This is the toning solution. After this immersion the articles are rewashed, dried, and are then ready for lacquering. If the high lights are to show relief this is best accomplished by hand relief, using pumice stone mixed to a stiff paste with water, a soft rag or a piece of felt. The relief work, of course, must be accomplished before lacquering. After the lacquer is thoroughly dry and hard the surface is usually waxed. This operation can be accomplished by the aid of a goats' hair wheel made up similar to a small Tampico wheel or hand brush made up of the same material. Beeswax mixed with turpentine to the consistency of stiff paste is used for the purpose of waxing. A little of the mixture is applied to the goats' hair wheel or hand brush and the surface is gone over in the manner of scratch brushing. This gives the opaque or egg shell finish.

If the bronze tone mentioned above is required to be of a deeper brown, then a five-second immersion in a solution consisting of eight ounces of sulphate of copper in one gallon of water, used cold, will darken the tone. This immersion would take place after the immersion in the antimony solution, and scratch brushing have been accomplished. If necessary the dark tone produced may be rescratch brushed after drying out. This will produce a more even luster. The use of a strong hot solution of sulphurett of potassium in the same manner as the antimony solution and the same manipulations before mentioned give good results. Dilute solutions of hydrochloric or sulphuric acid can be used for toning solutions instead of the acid copper if so desired, but not more than one ounce of the sulphuric or two ounces of the hydrochloric acid should be added to a gallon of water.

Another method that will also give good results on brass is as follows: Prepare a solution consisting of 8 ounces of sulphate of copper in 1 gallon of water and heat to 180 degs.; immerse the brass or bronze plated articles in the solution until an iridescent green is produced. This usually results in thirty or forty seconds; then wash the articles in clean water and immerse in a cold sulphurett of potassium solution, using 2 to 4 ounces in each gallon of water, for a few seconds. Then rewash, immerse in boiling water, dry out and lacquer. If the tone appears too light before lacquering give a quick second immersion in the sulphurett solution. These all give the toning effect on the second immersion. In like manner the hyposulphite of soda and the acetate of lead can be used, using 8 ounces of the former and 2 to 4 ounces of the latter in a gallon of boiling water. Immerse the articles after cleansing in the manner heretofore mentioned, then wash in water, immerse in the cold sulphate of copper bath as in the other operations before mentioned. A number of immersions are required to produce the brown tones, first from one solution and then the other, with rinsing in water between each immersion. After the brown tone is produced the surface should be scratch brushed and then lacquered. Many beautiful tones are produced by the soda and lead bath, the color changing every time the articles are immersed, washed and passed through the copper bath.

It can be readily seen from the methods given that the production of brown tones is due more to manipulation than the chemicals used. These tones can be readily produced, as noted from the foregoing, by the aid of sulphides in an alkaline solution preferably of the caustic alkali. In my experience the immersion processes give far better results than applications referred to in the first part of the article.

PLATINUM AS A USEFUL METAL.

Owing to the increasing demand for platinum for use in automobile, electric, photographic, dental and jewelry manufacture the price has of late been steadily rising, until at the present time platinum is regarded as a good investment. Jewelry manufacturers have turned from soft to hard platinum and are using the metal in much greater quantities than they did before. The hard platinum contains generally from 10 to 20 per cent. of iridium, which imparts the hardness to the alloy. The discovery and improvement of various alloys of platinum, giving advantages over the use of the soft metal, has led to its increased use in jewelry and in other trades.

As late as two or three years ago, jewelry manufacturers say, their only use of platinum was in the mounting of diamonds. Since then the metal has come into use in the mounting of other precious stones and also in the making of various articles of jewelry, such as watch and neck chains, in which the platinum displaces gold.

The platinum chains cost nearly twice as much as those of gold and may be seen in much variety in the big jewelry stores. The variation in the tints of platinum is a development from the use of alloys. Formerly the metal always had a silver white or gray tint, but now it is made in rich bluish tints. The silver color is said to be the best background to set off the brilliance of diamonds, but the other tints are adding to the popularity of the metal for other purposes. The iridium in the alloy gives the advantage of durability for the chains.

Soft platinum is now sold at $35.00 an ounce, which is an advance of $7 an ounce in ten months and $10 in a year. Two years ago this month it sold for $18.60, so it has gone up about 80 per cent. in that time. With 10 per cent. of iridium in the platinum alloy it now costs $35.50, and with 20 per cent. of iridium the price is $39. The alloys have gone up more rapidly than the pure platinum. Iridium in a separate condition has been going up most of all and is now quoted at $60 an ounce—double the price of three years ago. It has no commercial use except in making alloys. The alloy, osmiridium, also called iridosmine, used in making gold pen points, has been advancing with the other compounds.

Russian, French, German and English syndicates have from time to time controlled the chief sources of supply of platinum in the Ural Mountains in Russia. The iridium comes in the same ore and the two are often a natural alloy. The Russian Government is said to be restricting the output so as to boost prices. Wholesale dealers say that the increased use of the metal is the sole cause of the present advance in prices. Besides the supplies from Russia the wholesalers are now getting larger quantities than formerly from several States in this country, from Colombia, in South America, and also from Canada.

ON MAGNETIC ALLOYS FORMED FROM NON-MAGNETIC MATERIALS.*

REPORT OF A RESEARCH REGARDING THE MAGNETIC QUALITIES OF THE NON-FERROUS METALS AND THEIR ALLOYS.

BY ALEXANDER D. ROSS, M.A., B.S.c., F.R.S.E.†

Of great interest in the study of magnetism are the effects produced by alloying or admixing different elements. Many of those alloys have resultant propertes which give them important commercial applications. Thus chrome and tungsten steels, on account of their great retentivity, are specially suited for the preparation of permanent magnets. Again, the addition of such elements as silicon or aluminum to iron results in certain cases in increased susceptibility to magnetisation and reduced hysteresis loss, thus rendering the material well adapted for transformer working.

MATERIALS EMPLOYED.

In the preparation of the alloys every endeavor has been made to obtain materials of the highest purity. Electrolytic copper was used in all cases, and contained less than 0.15 per cent. total impurity. The manganese selected was prepared by the thermite process. It contained about 98.5 per cent. of manganese, the remainder consisting chiefly of silicon, iron, and aluminum.

The presence of aluminum in the manganese may possibly have influenced slightly the results obtained in ternary groups other than the copper-manganese-aluminum alloys, as the addition of aluminum to manganese produces a magnetic material. The amount of aluminum introduced in this way was always very small, and the consequent error in the results must therefore be almost or entirely negligible. The iron impurity is of no greater moment, as alloys prepared by the use of ferro-manganese, and hence having a decidedly larger iron content, showed almost identical magnetic properties. The presence of small quantities of silicon has no effect on the magnetic properties except in so far as it reduces the amount of magnetic material in the specimens. The thermite manganese thus contains no objectionable impurity. On the other hand, it possesses a great advantage in that it has a very low carbon content, only a trace of that element being present. This is important, as the presence of carbon has a powerful influence in modifying the equilibria of manganese alloys, and also produces change in the magnetic properties of manganese itself.

PREPARATION OF THE SPECIMENS.

In the preparation of the ternary alloys, the plan adopted was to make first a manganese-copper alloy and then to add the third metal to it. As a rule, the manganese-copper was composed to these elements in the weight ratio of 3:7, that ratio giving the alloy of lowest melting-point in the binary system (about 870 degs. Cent.). In this way there was little or no loss through volatilization, etc., on adding the third contituent. On account of the extreme readiness with which hot manganese absorbs carbon, special precautions had to be taken to prevent the admission of this element. In general, therefore, the alloying was conducted in a "Salamander" crucible under a layer of fused barium chloride. Charcoal cannot safely be employed unless the percentage of manganese present is small. The metal was cast in dry sand moulds lined with whiting. When moist sand was tried, it was found that the material was invariably of somewhat inferior magnetic quality and could not be brought quite up to the standard by annealing or other heat treatment. The alloy was cast vertically in the form of cylindrical rods about 9 inches long and 7/16 inch in diameter. The binary alloys were prepared in much the same way, except that the majority of them, being too feebly magnetic to test by the usual methods, were cast as small rods measuring about 4½ inches by ¼ inch, and were tested between the poles of a powerful electro-magnet. These bars were in all cases sufficiently long to allow a small piece to be cut off the lower end and rejected, and two further portions—one from either end—to be taken for chemical analysis, leaving a rod of suitable dimensions for the magnetic test.

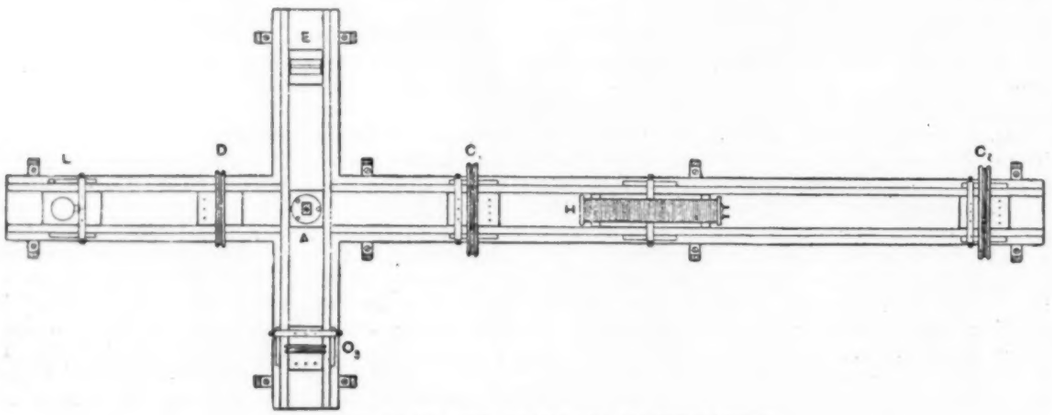


FIG. 1—PLAN OF THE GRAY-ROSS MAGNETOMETER.

INVESTIGATION OF THE MAGNETIC PROPERTIES.

The programme of the magnetic tests on the ternary alloys was as follows:

1. To determine the magnetic quality of the alloys in the condition as cast.

2. To find the simplest and most efficient heat treatment for bringing the alloys into a stable condition with the highest possible magnetic quality.

3. To investigate the changes produced in the magnetic properties by exposure of the alloys to different temperatures to determine the critical temperatures and to investigate the reversibility of the thermal treatment.

* From a paper read at Glasgow meeting of Institute of Metals, Sept. 21-23, 1910.

† Lecturer on natural philosophy in the University of Glasgow.

4. To examine the effects produced by quenching, annealing, and baking the alloys.

The tests were carried out on a magnetometer specially designed by Dr. J. G. Gray and the author for investigations of this kind.** The main feature of the instrument (Fig. 1) is the simple and novel method introduced for rapidly securing accurate compensation of the effects due to the electric current in the magnetising solenoid. The magnetometer proper (A), the solenoid (H), the compensating coils (C_1, C_2, C_3), and the lamp (L), for showing the movement of the magnetometer needle, are all mounted on a strong mahogany baseboard, and move freely in channelled beds. They can be firmly fixed by friction clamps. C_1 is the principal compensating coil, C_2 a coil for fine adjustment, while C_3 removes any error due to want of proper alignment of the other coils. When tests were to be carried out at temperatures above normal, the specimens were placed in an electric furnace of the newest type*** for use within the magnetising solenoid. In this the alloys could be raised to temperatures approaching their melting point without danger of oxidation ensuing.

When in some cases it was desired to maintain specimens for more than a day at a moderately high temperature, the bar was, as an additional precaution, tightly packed with pure kaolin clay in a copper tube inserted in the furnace. The kaolin clay used for this purpose was previously strongly heated and then powdered so as to prevent subsequent shrinkage when used as a protection for specimens. The measurement of temperature was effected by a platinum, platinum-iridium thermo-element used in conjunction with a millivoltmeter. This apparatus was calibrated before and after the tests by determination of five boiling and freezing points, and was found to have remained unchanged during the interval. While the arrangement was not so sensitive as one involving null methods with the potentiometer or wire-bridge, it was sufficiently accurate for the purpose in view, and was, moreover, preferable on account of its simplicity.

SCOPE OF THE RESEARCH.

Magnetic tests have been carried out on alloys belonging to the following ternary systems:

1. Copper-manganese-aluminum.
2. Copper-aluminum.
3. Copper-manganese-antimony.
4. Copper-manganese-bismuth.

In the case of the first two systems several members of the group were prepared and tested, so that the effects produced by thermal treatment and their variation with the composition of the alloy might be fully studied. In the two latter cases the object of the tests was merely to compare in a general manner the properties of these systems with the two former. One or two castings accordingly sufficed for the purpose.

The binary groups tested comprised the following:

1. Copper-manganese.
2. Copper-aluminum.
3. Manganese-antimony.
4. Manganese-boron.

The object of these investigations being to ascertain the magnetic properties of the various intermetallic compounds formed, the number of specimens required was again small.

**J. G. Gray and A. D. Ross, Proceedings of the Royal Society of Edinburgh, 1909, vol. xxix, p. 182; Philosophical Magazine, July, 1909.

***J. G. Gray and A. D. Ross, Proceedings of the Royal Philosophical Society of Glasgow, 1910, p. 41.

COPPER-MANGANESE-ALUMINUM AND COPPER-MANGANESE-TIN.

The alloys, to which reference will hereafter be made, were found on analysis to have the following compositions:

TABLE I.—Compositions of Cu + Mn + Al, and Cu + Mn + Sn Alloys.

Alloy.	Percentage Composition. Cu. Per Cent.	Mn. Per Cent.	Al. Per Cent.	Sn. Per Cent.
1	75.5	16	8	....
2	62	25	12.5	....
3	54	30	15	....
4	60.2	25.1	....	14.1
5	58.7	23.5	....	16.1
6	57.6	24.9	....	18.0
7	49.2	20.4	....	29.8
8	43.4	18.1	....	40.0
9	36.4	15.0	....	48.1

Of the first group No. 2 was by far the most strongly magnetic, and in the second group No. 8 was the best. Nos. 7 and 9 were only very feebly magnetic. In what follows the results obtained for alloys 2 and 8 will generally be given, values being added for the others only when they show special features of interest.

The alloys were first of all tested as cast, that is, without any preliminary dressing operations, with the exception of the removal of the end portions as described above. Tests were made with the material (1) at room temperature, and (2) when cooled down to — 190 degs. Cent. For the latter test the specimen (A, Fig. 2) was placed in a glass tube (BCD), one end (B) of which was closed while the other (CD) was open and curved upwards. The tube was supported by cork bungs (FF), so that the specimen lay along the axis of the magnetising solenoid (EE). Liquid air was poured in at D, and a steady temperature was soon attained, as the corks prevented access of warm air from without. Table II gives the results obtained in tests at 15 degs. and — 190 degs. Cent.

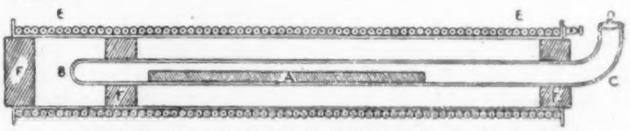


FIG. 2—DETAIL OF APPARATUS FOR TESTING INTENSITY OF MAGNETIZATION.

TABLE II.—Tests of 15 degs. and — 190 degs. Cent.

Applied Field, H.	Intensity of Magnetization. Cu+Mn+Al. Alloy 2. 15°	Cu+Mn+Al. Alloy 2. —190°	Cu+Mn+Sn. Alloy 8. 15°	Cu+Mn+Sn. Alloy 8. —190°
20	254	300	21	21
50	292	358	53	53
100	310	388	95	95
200	324	401	159	160
Residual	85	160	11	11

The effect of cooling to liquid-air temperature is large in the case of the aluminum alloy, and practically nil in the case of the tin alloy. This liquid-air effect, however, varies greatly in different members of the same series. Table III. gives the percentage improvement in the values of I corresponding to H = 100 for the various alloys referred to in Table I.

TABLE III.—Improvement in Quality by Cooling to — 190 degs. Cent.

Alloy.	1	2	3	4	5	6	7	8	9
Percentage increase in I for H=100	20	25	—1	21	26	35	1	0	0

The improvement in quality of these alloys on cooling to — 190 degs. is an interesting and somewhat character-

istic feature, as most magnetic materials, such as iron, steel, iron alloys, nickel and cobalt, are in general less susceptible to magnetization at low than at normal temperatures.

It has been found that the majority of those bronzes are improved in quality by exposure for some time to temperatures between 150 degs. and 200 degs. Cent. The improvement has usually a double origin. First, it removes the strains generally left in the material by the process of casting; and, secondly, it results in constitutional change, the material being brought into a new equilibrium condition. In most cases this improvement can be affected in two steps, corresponding with the two distinct processes involved. Thus, if the metal is heated to, say, 180 degs. Cent., and then cooled comparatively slowly, the internal strains are removed. The alloy now gives a magnetisation curve of precisely similar shape to the initial one, but with each ordinate slightly larger. The percentage improvement in quality on cooling to — 190 degs. Cent. is unaltered—the thermal treatment has resulted merely in a "normalising" of the alloy. If now the metal be heated to the same temperature and kept thereat for several hours previous to the slow cooling back to room temperature, we have an annealing process resulting in constitutional change of the material, which is altered from a metastable condition towards the true equilibrium condition corresponding to temperatures not far removed from room temperature.

In the case of the copper-manganese-aluminum alloys the normalising has comparatively little effect, but considerable improvement can be obtained in some instances by annealing or baking at temperatures about 170 degs. Cent. for six to eight hours. With alloy No. 2 this results in an increase in the saturation value of I of as much as 10 per cent., while the hysteresis is not appreciably augmented. It is different with the copper-manganese-tin alloys. Normalising not infrequently produces a decided improvement in quality, but annealing or baking results in an increased hysteresis loss which more than counterbalances any advantage derived from the slight improvement in susceptibility. Prolonged baking, especially at moderately high temperatures, has invariably an adverse influence, although the resultant effect varies irregularly with the temperature employed,* pointing to complex structural changes.

The quenching of the alloys at high temperatures has revealed several interesting facts. The copper-manganese-aluminum alloys are always less magnetic after this treatment, but it is noteworthy that the coercive force, and consequently the hysteresis, are greatly diminished. Coercive force is a quantity which varies greatly in different materials, as will be seen from the figures given in Table IV.

TABLE IV.—Coercive Forces.

Material.	Coercive Force. C.G.S. Units.
Very soft iron	1.7
Cast iron	4
Annealed carbon steel	20
Quenched tungsten steel	50
Cu+Mn+Al alloy No. 2	1.3
Do quenched at 50 degs.	Less than 0.3
Cu+Mn+Sn alloy No. 8	9
Do quenched at 400 degs.	6

The exceedingly small value of the coercive force for alloy No. 2 after quenching at 550 degs. is remarkable, considering that the material is still comparatively magnetic, having a permeability of over 100 for H = 20, that is to say, a value little inferior to that for cobalt. The quenched alloys are in an unstable rather than a metastable condition. If left at room temperature for several months they gradually improve in magnetic quality, and finally attain a permeability little less than that which they had prior to the quenching. Thus a specimen of alloy No. 2, which had initially a permeability $\mu = 160$ for $H = 20$, had $\mu = 130$ after quenching at 400 degs. Cent. In the course of a year μ had risen to over 157. This improvement in quality was not accompanied by any appreciable increase in the small value of the coercive force for the quenched material. We thus obtain a material of fair permeability and with extremely little hysteresis loss. This is at least an approximation towards the ideal magnetic substance, which should be highly magnetic and without hysteresis. The recovery of magnetic susceptibility with time of the quenched copper-manganese-aluminum alloys was first pointed out by the author early in 1907.* Asteroth has since shown that the recovery can be accelerated by exposure of the alloy to a temperature of 140 degs. or 160 degs.† Heusler and Richarz have recently suggested that this material might be useful in the construction of electrical measuring instruments on account of its vanishingly small hysteresis.‡ In the author's opinion, however, this seems unlikely for several reasons. The alloys are exceedingly hard and brittle and almost unworkable. They are also very sensitive to change of temperature, and ageing from exposure to heat has a much more deleterious effect on them than on iron and steel.

As already stated, copper-manganese-aluminum alloys are always less magnetic after quenching, but the resultant susceptibility does not steadily diminish with increasing temperature of quenching. On the contrary, alloy No. 2 is much more magnetic after being quenched at 700 degs. Cent. than after quenching at 600 degs. Cent. With the copper-manganese-tin alloys the effect of quenching is even more complex. When the quenching is carried out at temperatures high above the critical temperature the material is always rendered almost non-magnetic. But if quenching is carried out at moderate temperatures, the alloys are sometimes almost as magnetic as before this treatment.

COPPER-MANGANESE ANTIMONY AND COPPER-MANGANESE BISMUTH.

Experiments made on copper-manganese-antimony alloys showed them to have properties very similar to those of the copper-manganese-aluminum alloys. The bismuth bronzes, however, differed in one or two important particulars from the others. The fact that these metals are ferro-magnetic at all is rather remarkable when we consider the nature of the constituent elements. Manganese is only very feebly paramagnetic, while copper is slightly, and bismuth comparatively strongly diamagnetic (that is to say, much less magnetic than what we commonly term empty space). Those elements nevertheless combine to give alloys with decidedly ferromagnetic properties. This will be seen from Table VI, which gives the results obtained in a test on an alloy with the approximate composition: copper 43 per cent., manganese 17 per cent., bismuth 39 per cent. This material became much more magnetic on quenching at 300 degs. Cent., the treatment resulting in an enhancement of over 60 per cent. in the intensity of magnetisation for an applied field of strength about 200 gauss. The retentivity was greatly increased, and the coercive force was also augmented instead of undergoing reduction as in the other

* A. D. Ross and R. C. Gray, Proceedings of the Royal Society of Edinburgh, 1909, vol. xxix, p. 274.

* A. D. Ross, Proceedings of the Royal Society of Edinburgh, 1907, vol. xxvii. p. 88.

† P. Asteroth, Inaugural-Dissertation, Marburg, 1907; Verhandlungen der Deutschen Phpsikalischen Gesellschaft, 1908, vol. x. p. 21.

‡ F. Heusler und F. Richarz, Zeitschrift für anorganische Chemie, 1909, vol. lxi. p. 265.

ternary systems. Cooling to liquid air temperature lowered I for H = 200 by over 30 per cent. in the case of the cast material, and by about half of this amount in the case of the alloy as quench at 300 degs. Cent.

TABLE VI.

Magnetization Curve for Alloy (Copper 43 per cent., Manganese 17 per cent., Bismuth 39 per cent.)

Applied Field.	Intensity of Magnetization.
50	2
100	5·5
200	12
Residual	2
Coercive force	Circa 40

THE MAGNETISM OF THE COPPER-MANGANESE-ALUMINUM ALLOYS.

The 10 per cent. aluminum bronze referred to above differed from all the others tested in that it contained the intermetallic compound Cu_3Al.* As alloys approximating in composition to this formula were apparently the most magnetic of the aluminum-copper series, the view was expressed that this compound played an important part in the magnetism of the copper-manganese-aluminum alloys.† Shortly afterwards Heusler and Richarz published a somewhat similar hypothesis based on tests of a different kind.‡ These experimenters, having gathered data for some thirty or forty manganese-aluminum bronzes, found that on marking the alloys on a ternary diagram (Fig. 3) the most highly magnetic lay approximately along the line joining the points which represent Cu_3Al and Mn_3Al. They accordingly advocated the theory that the tenary alloys contain magnetic compounds consisting of aluminum in chemical combination with manganese and copper so that in every case each atom of aluminum is associated with three atoms of the other metals. In other words, they postulate the occurrence of a series of ternary magnetic compounds represented by the general formula CuxMnyAlz, where x and y may have any of the values 0, 1, 2, . . . , and $x + y = 3z$.

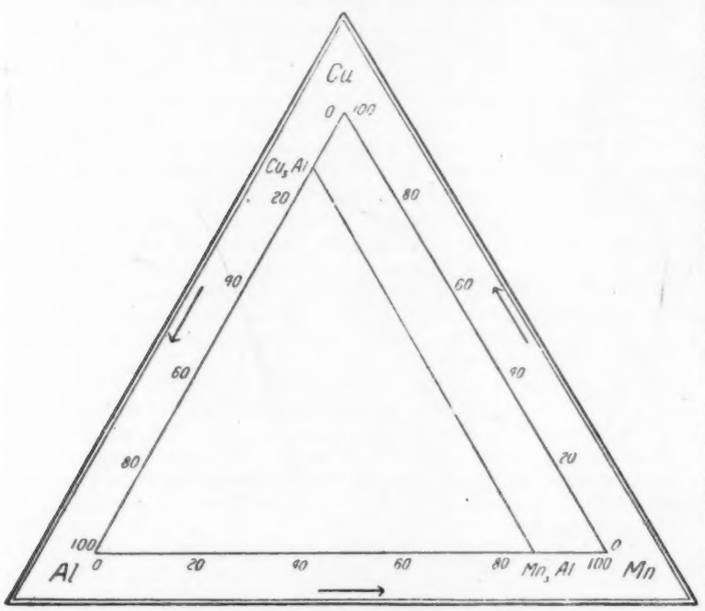


FIG. 3. COPPER-MANGANESE-ALUMINUM TERNARY DIAGRAM.

This theory seems unsatisfactory for several reasons:

1. Ternary compounds are almost unknown. Indeed, with the exception of CdHgNa and Hg_2KNa§ we have no reliable evidence of their occurrence.

2. No ternary compounds were found in the portion of the copper-manganese-aluminum system investigated by Rosenheim and Lantsberry, although several of their alloys were decidedly magnetic.‖

3. If such compounds did exist, there would be no reason why they should show quenching and liquid effects identical to those in Cu_3Al. The extremely close correspondence between the magnetic behavior of Cu_3Al and the ternary bronzes would therefore be a chance coincidence, which seems very improbable.

On the other hand, the author adhers to his former view that the magnetic properties are due to the formation of solid solutions, of which the compound Cu_3Al is a constituent. Mn_3Al is known to be the most magnetic of the manganese-aluminum alloys.* It is possible, then, that a series of solid solutions occur between the compounds Cu_3Al and Mn_3Al, and give rise to the ferromagnetism of the ternary alloys. It should be noted, however, that, owing to the great difficulty of obtaining satisfactory castings, no ternary alloys with less than 60 per cent. copper have been tested along the line joining Cu_3Al and Mn_3Al. Accordingly one cannot be certain as to whether the solid solutions are formed merely between Cu_3Al and Mn_3Al, or whether uncombined manganese enters into them. There are certain considerations which make the presence of free manganese probable, and with a view to gaining further information on this point the author has taken in hand the microscopic examination of the ternary ferro-magnetic alloy and also magnetic tests on manganese-aluminum alloys.

It may be asked why solid solutions of Mn or Mn_3Al in Cu_3Al should result in the production of a material so much more magnetic than either of its constituents. No direct explanation can at present be given, but we have analogous instances. Thus the addition of small quantities of aluminum and other elements to iron with the formation of solid solutions leads to materials more magnetic than iron, although the added element is itself non-magnetic.** Again, copper-aluminum alloys containing aluminum in increasing proportions up to 8 per cent. consist of solid solutions which are the more retentive of magnetism the greater amount of aluminum present.† Why the presence of a non-magnetic constituent should enhance the magnetic quality of a material is a difficult question to answer. Perhaps the action is somewhat similar to that in which we find nickel and other allied elements altering the recalescence point Ar_2, at which iron transform from the non-magnetic to the magnetic condition. The solution of the problem would be of great interest alike to physicists and metallurgists, and it seems probable that satisfactory progress is most likely to be attained by extensive magnetic tests on alloys conducted in combination with metallographic investigation.

The researches are not yet sufficiently advanced to permit of a discussion as to the origin of the magnetism of the copper-manganese-tin alloys. Meanwhile, however, it may be stated that a similar solid solution hypothesis seems applicable in this case also. It may be of interest

* For the compositions of aluminum-copper alloys, see H. C. H. Carpenter and C. A. Edwards, Proceedings of the Institution of Mechanical Engineers, 1907, p. 57; B. E. Curry, Journal of Physical Chemistry, 1907, vol. xi. p. 425.

† A. D. Ross and R. C. Gray, Proceedings of the Royal Society of Edinburgh, 1909, vol. xxix. p. 274.

‡ F. Heusler and F. Richarz, Zeitschrift für anorganische Chemie, 1909, vol. lxi. p. 265.

§ E. Jänecke, Zeitschrift für physikalische Chemie, 1906, vol. lvii. p. 507.

‖ W. Rosenhain and F. Lantsberry, Proceedings of the Institution of Mechanical Engineers, 1910.

* G. Hindricks, Zeitschrift für anorganische Chemie, 1908, vol. lix. p. 414.

** W. F. Barrett and W. Brown, Journal of the Institution of Electrical Engineers, 1901, vol. xxxi. p. 675.

† R. C. Gray, Proceedings of the Royal Philosophical Society of Glasgow, 1910, p. 41.

to point out in this connection that the copper-manganese-tin alloys have been found to fall into two distinct magnetic groups, and that manganese and tin form magnetic compounds Mn_4Sn and Mn_2Sn,* whereas manganese and aluminum form only one magnetic compound Mn_2Al.†

The work described in the present paper has been carried out in the Physical Institute of the University of Glasgow, and the author desires to acknowledge his indebtedness to Professor Gray for the facilities granted for conducting the investigations.

* R. S. Williams, Zeitschrift für anorganische Chemie, 1907, vol. lv. p. 1.
† G. Hindricks, ibid., 1908, vol. lix. p. 414.

THE GUN-METAL FINISH ON STEEL

Its Nature and Production.

BY IONIC.

The genuine gun-metal finish on steel as originally produced on gun barrels is considered the best black that can be produced by chemical methods. The process consists in producing on the finished article the black oxide of iron, which has the chemical formula Fe_3O_4. This black oxide when properly produced is rust proof for the reason that the iron in this condition will not take up any more oxygen and corrosion ceases. This process seems to have originated in the gun shops and has been preserved as a secret by the gunsmiths. The formula, subsequently given, is used in some of the largest gunshops in the country and also by some of the largest hardware manufacturers. In recent years this finish is being produced on carpenter's squares, hammers, dividers, pliers, bit-braces, chisels, hatchets, etc. It makes a very suitable finish for this class of goods.

The formula for producing this finish is as follows:—

Water	4 ozs.
Alcohol	4 "
Ferric Chloride	½ "

The water and alcohol are mixed together and then the ferric chloride is added, which will readily dissolve without heat. The solution should be tightly corked until ready for use.

The articles to be finished are first polished and thoroughly cleaned of all grease as if for plating, otherwise the solution will not corrode properly. After cleaning it is run through hot water and allowed to dry in the air or clean sawdust may be used. The solution is applied with a sponge to the article to be finished. Care should be taken that the sponge is thoroughly squeezed out before applying it to the work. It is absolutely necessary to have it just moistened and applied evenly over the surface of the work. If a large quantity of solution is applied to the article the finish cannot be produced, and the result will be a surface dotted with white spots and unevenly corroded.

After the work is properly sponged it is placed in a warm, moist atmosphere. To produce the necessary moisture and heat a brick lined or cemented chamber is used, suitable to the requirements of the work to be corroded. A wooden chamber may also be used if desired. The temperature within this chamber should be about 100 degrees Fahr. For this purpose a coil of steam pipe is introduced and the exhaust from the coil is used to produce the necessary moisture. It is desirable to have a transom or lintel arranged at the top of one end of the chamber to furnish a means for the steam to escape when it is necessary to remove the work. It is also desirable to place either in the door of this chamber or any other suitable location, a small glass window about a foot square. By this means the quantity of moisture within may be ascertained by the quantity of water vapor that condenses upon the glass. Too much moisture is undesirable and the exhaust valve should be shut off when the chamber is thoroughly moistened.

The work to be treated is left within this chamber for forty-five minutes, and will then in most cases be covered with a slight rust. It is then removed and placed in clean boiling water for fifeen minutes. For this purpose a wooden vat fitted with a steam coil may be used. The work when removed from the hot water is allowed to dry in the air, when it will be found to be covered with a soft black oxide. It is then scratch brushed on a soft circular iron wire brush, revolving at 800 to 1,000 revolutions per minute. After scratch brushing it will be found that most of the soft black oxide is removed and the surface of the work is of a grayish black color. To obtain the beautiful black oxide noticeable on gun barrels it is necessary to repeat the sponging with the solution and again place in the steaming chamber for the same length of time, finishing with the hot water treatment and scratch brushing. Usually it is necessary that the operation be repeated three times, when a good black oxide is obtained. On some work two operations are sufficient, but with malleable iron it may be necessary to repeat the operation four or five times to obtain a first class finish. Malleable iron will not corrode as readily as steel, possibly due to its porous nature. The solution collects in the pores and has a tendency to spot out. After the final scratch brushing the article is wiped with linseed oil, using a clean cloth, and considered finished.

Chemically the process takes place according to the equation

$$Fe_2Cl_6+3H_2O=Fe_2O_3+6HCl$$

The Fe_2O_3, which is the red oxide of iron or ordinary iron rust, is produced in the steaming chamber. When the work is given the hot water treatment the red oxide is converted to the black oxide, according to the equation

$$FeOFe_2O_3 + H_2O=Fe_3O_4 + H_2O$$

When the work is placed in the steaming chamber the hydrochloric acid, HOl, is driven off. A practical illustration of the conversion of red oxide to black oxide may be carried out by taking any rusty piece of steel and placing it for fifteen or twenty minutes in clean boiling water. It will then be found that the red oxide has been converted to the black oxide. Of course oxidation that has been produced by long exposure to the atmosphere is generally too rough and uneven to produce a good finish and it will not have the lustre of the finish described in this article.

It is preferable to use good grain alcohol in making up the solution. The alcohol acts as a binder and

aids corrosion. Fairly good results may be had without the alcohol. If more than the quantity of ferric chloride given in the formula is used the black oxide cannot be produced for the reason that the solution would be too strongly acid and would dissolve the black oxide on the second application of the solution. After many experiments the proportions given in the formula have been found to produce the best and quickest results. A solution of ferric chloride has a tendency to precipitate the iron in the oxide form, especially when exposed to the air. For this reason the solution should be made in small quantities as required. The same mixture should not be used for more than two or three days. It will be found that a few ounces will be sufficient for this time.

It is the practice in many factories to use sodium carbonate or kerosene oil and similar substances in the boiler to prevent rusting. Where this is done the steam should not be allowed to condense in the steaming chamber or it will ruin the operation. When the addition of soda or kerosene oil is used in the boiler, work should be stopped until these chemicals are driven out of the pipes or considerably diluted. Suitable hooks or frames made of steel wire should be used for placing the work in the steaming chamber, and the hot water bath. The pieces should not be allowed to touch each other and should not be handled with greasy hands.

RESUMÉ.

Briefly the process is carried out as follows:

1. Polishing the article.
2. Cleaning from all grease and dirt.
3. Sponging with ferric chloride solution.
4. Steaming the work for forty-five minutes.
5. Hot water treatment for fifteen minutes.
6. Scratch brushing.
7. Repeating operations 3, 4, 5, and 6 two or three times.
8. Oiling with linseed oil and drying.

A comparison between this process and the so-called Bower-Barff finish is interesting. Both processes produce the black oxide of iron, Fe_3O_4, but the methods of producing it widely differ. Briefly the Bower-Barff process consists of heating the iron to a red heat in a retort containing superheated steam. About 1,000 degrees of heat is used to produce the black oxide. For this reason the Bower-Barff process cannot be used for general hardware, especially edge tools. It is also apt to form a scale on account of the large quantity of the black oxide being formed. The process described in this article gives a very smooth finish and cannot by any possibility form a scale, as very little heat is used. This process has been used for many years for producing the black oxide on gun barrels, and many solutions are given in the technical books for producing it. The writer has tried a very large number of these formulae with poor results. It is believed that the formula given here has never been published heretofore. Metallurgical history does not record who first used the process or where it actually originated. There seems to be no record of any patents being issued on this process or any similar process for producing the black oxide. It seems that the process originated in the gun shops and has been regarded as a secret for many years. Quite large sums have been paid for this process by some of the large hardware concerns in the East.

DURALUMIN, A NEW ALLOY

SOME INTERESTING DATA REGARDING THE ALUMINUM COPPER ALLOYS TO WHICH THIS NEW METAL BELONGS.

BY JESSE L. JONES.*

If it fulfils the claims made for it, this new alloy may be safely said to be the best light aluminum alloy mentioned in the September number of THE METAL INDUSTRY that has been brought out for forging and rolling. The metallurgical world, however, would be much more interested in an aluminum casting alloy that possessed the strength and durability of yellow brass, but an alloy such as duralumin is claimed to be, that can be made into extended shapes, sheets, wire, rods, tubes, endless ribbon, etc., is of more than ordinary interest.

The rolling alloys that have met with the most favor in the past have been made of aluminum hardened with small amounts of copper. Dr. Richards gives the following as the physical characteristics of some of these alloys when rolled into sheets of 0.039 inch thickness, the experiments having been made at the Aerostatic Park at Mendon.

Per cent of Copper.		Observed Specific Gravity.		Tensile Strength
0	—	2.67	—	26,500
2	—	2.71	—	43,500
4	—	2.77	—	44,000
6	—	2.82	—	55,000
8	—	2.84	—	56,000

As long ago as 1894, the writer made tests on a plate rolled to a thickness of 0.247 inch from an alloy furnished by the Pittsburg Reduction Company and known as "nickel aluminum." The results obtained were as follows:

Tensile strength	40,786
Elongation in 2"	5.0%
Reduction of area	10.6%

This alloy had a fine white color and in addition to being very strong was quite hard and elastic. It was evidently made with German silver, judging from its analysis, which follows:—

Aluminum	96.67
Copper	1.89
Iron	56
Nickel	27
Silicon	41
Zinc	20

More recently the use of nickel for hardening aluminum seems to have been abandoned, but various copper-hardened alloys, deoxidized by the use of manganese, phosphorus, etc., have been brought out in the United States. None of these alloys has given the results claimed for duralumin or much exceeded the figures given above for "nickel aluminum."

Duralumin is the invention of A. Wilm, Berlin, Schlatensee, and is made by the Dürener Metalwerke Aktiengesellschaft, Düren, Rhineland, makers of Durana metal and other alloys. The manufacturer gives the following data in regard to Duralumin:—

"Duralumin is an aluminum alloy with more than 90% aluminum. The specific gravity is below 2.80. The melting point is about 650°C (1202°F). Duralumin may be rolled either hot or cold and may be forged or drawn.

* Metallurgist, Westinghouse Electric and Manufacturing Company.

COLD-ROLLED SHEET.

Thickness. Inches.	Tensile Strength.	Elastic Limit.	Elongation. Per Cent.	Reduction. Per Cent.	Hardness, Brinell.
0.275	65,427	42,669	18	26	125
0.236	72,538	68,271	7	17	144
0.157	81,072	76,805	4	11	159
0.118	85,338	82,494	3.5	11	166
0.078	88,184	85,338	3.5	10	174

ANNEALED SHEET.

Mark.	Tensile Strength.	Elastic Limit.	Elongation. Per Cent.	Reduction. Per Cent.	Hardness, Brinell
H	51,203	27,024	25	34	98
681	65,427	42,669	18	26	125

"The alloy is furnished not only in sheets but in the form of wire, tubes, etc."

Some small samples of the alloy that had evidently been extruded were furnished by Max Hamscher, Halensee, Germany. They were not large enough for physical tests but an analysis was made that gave:—

Aluminum	94.60
Copper	3.90
Iron	.45
Magnesium	.75
Manganese	Trace
Phosphorus	Not determined
Silicon	.21
Zinc	Nil
Specific Gravity	2.79

It is evident that duralumin is simply a copper-hardened aluminum alloy that has been made from very pure aluminum and its makers have succeeded in thoroughly deoxidizing it so as to secure the greatest possible ductility and strength.

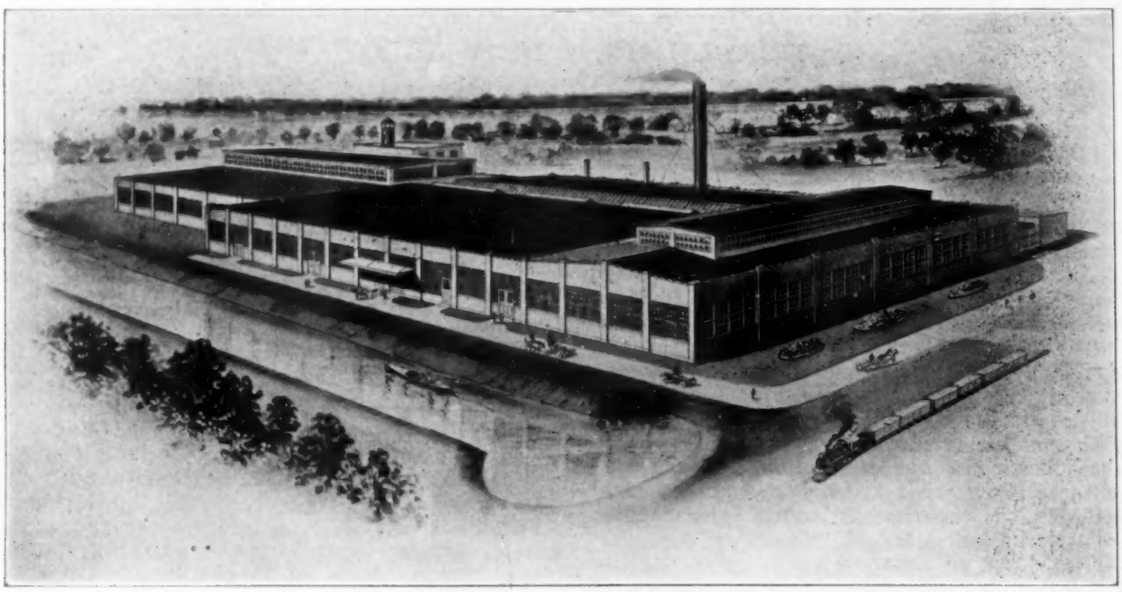
While it is probable that the physical characteristics claimed for duralumin can be secured, it is very doubtful whether such figures can be guaranteed regularly in the product unless the utmost care is used in every step of its manufacture.

A NEW AUTOMOBILE CASTINGS FOUNDRY

With an entirely new plant, shown in cut, completed, a prominent new automobile parts company is operating in Detroit, Mich. This new concern is the Fairview Foundry Company, of which F. L. Bromley is president; J. W. Thompson is vice-president; C. A. Pfeffer, secretary and treasurer. The board of directors consists of the officers and High Chalmers.

The Fairview Foundry Company makes all the castings for the Chalmers Motor Company, and in addition specializes in marine gas engine castings. The plant is divided into two parts, one equipped with the most modern machinery for the casting of brass and aluminum, and one for gray iron. In this way all confusion of materials and possibility of poor work is eliminated. The company makes only the highest grade castings. The equipment of the brass foundry consists of three aluminum, and three brass furnaces, manufactured by Alfred Fisher, of Chicago, Ill. The output of the aluminum foundry is two tons per day.

F. L. Bromley, the president, is one of the best and most experienced practical foundrymen in Detroit. He was 18 years with the Michigan Stove Company, during which time he worked through the factory and office end of the foundry department. He then organized the Detroit Foundry and Manufacturing Company, wihch, after two years, was merged with the Detroit Stoker and Foundry Company. As head of this concern, he made automobile castings from the very beginning of the industry. Since the incorporation of the Buick Automobile Company, Mr. Bromley has made the Buick castings. As that company grew the work became heavier, a branch known as the Michigan Motor Castings Company was started in Flint. This was later sold to the General Motors Company. Mr. Bromley also organized the American Motor Castings Company, probably the largest producer of automobile castings. At the present time the E-M-F Company buys practically the entire output of the old foundry. The Fairview Foundry Company has a nominal capital of $10,000, but this does not give any indication of the volume of business done.



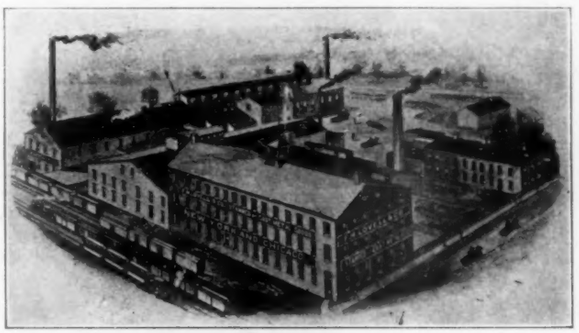
PLANT OF THE FAIRVIEW FOUNDRY COMPANY, DETROIT, MICH.

WHERE THE MARINE LIGHTING FIXTURES USED BY THE UNITED STATES GOVERNMENT ARE MADE.

By Chas. H. Proctor.

The extensive plant of F. H. Lovell & Company, where the greater majority of all the marine lighting fixtures used by the United States government are made, is located at Arlington, N. J., on the Greenwood Lake branch of the Erie railroad, approximately eight miles due west from City Hall, New York. This plant, although practically in its infancy, bids fair to assume very large proportions within a few years.

So rapid has been the advance in demand for goods manufactured by this firm that several times within the past five years they have had to enlarge the producing power of their plant to keep pace with the ever-increasing demands for their products. Although theoretically new in the manufacturing business, the older or parent firm of



THE F. H. LOVELL FACTORY AT ARLINGTON, N. J.

F. H. Lovell & Company have been in existence in New York City for more than forty years, and have an enviable world-wide reputation for the excellency of their lighting supplies and fixtures of all descriptions. Not only is this firm's trade-mark well known from the Atlantic to the Pacific coast of America, but in all parts of the civilized world the excellency of their products is favorably known.

CARGO REFLECTOR.

It does not seem possible that a plant of the proportions of the F. H. Lovell company could be almost entirely kept busy in the manufacture of the United States government marine lighting fixtures, but when we take into consideration that a battleship of the proportions of the New Hampshire, recently built at the New York Shipbuilding Company's yards, at Camden, N. J., requires 1,200 lighting fixtures of various descriptions, besides nearly 2,000 electrical interior fittings, consisting of the various distribution, feeder, junction branch switch and numerous other fittings, it is no wonder that a concern of this size can be constantly employed in their manufacture. This is also partly due to the fact that constant improvements in the electric lighting of Uncle Sam's

MASTHEAD ELECTRIC LIGHT.

floating fortresses necessitate constant changes in the various types, so that within a period of a few years existing fixtures become obsolete and new types take their place; so there is an almost endless demand for marine lighting fixtures for government use. The concern that is efficiently equipped to accomplish the minute details required and meet contract requirements in price and finished product is the concern that is kept constantly employed to fill the demands made upon them.

F. H. Lovell & Company have been so far during their career in this field unusually successful in meeting all the contract requirements and urgent demands they have been called upon to meet. This has been due to the expenditure of large sums of money in the purchase of the latest designs of modern machinery, and the employment of the best of skilled labor, and to the untiring efforts of James H. Callender, the president and treasurer of the company, whose aim it has been to keep rapidly in advance of all competitors in this particular field.

This company also manufacture fixtures for United States army fortification work, also commercial marine fixtures of various types and descriptions, and their products are recognized by shipbuilders who do government work as fully up to the recognized government types; so in this branch the demand is constantly on the increase.

The marine fixtures of the United States government are made entirely of the non-ferrous metals, consisting of copper, bronze and brass; no iron or steel of any de-

scription is used, owing to the corrosive action of the salt water. All fixtures are finished in dark gun metal, which is termed "Navy Bronze." Until recently some firms unable to produce this color resorted to a dead lacquer finish, and this was accepted by the government, but in later specifications this finish is rigidly excluded, and all fittings must be finished in the manner mentioned with a true bronze. This finish withstands the action of the salt water very well, and rather improves than diminishes in effect with age. All castings, whether made of bronze or brass, are mixed from government formulas furnished to the contractors, and must be of the specified composition and strength and subject to analysis. This may seem unnecessary to persons working in similar lines of work. Blueprints of the working drawings covering every detail of manufacture and assembling are furnished by the government, and when carried out carefully, parts, that are made in the various departments according to the drawings, when finally assembled as a whole fit as nicely as the leaves of a book, and the intelligent workman knows that by following his drawing correctly his work cannot be otherwise than well done.

In addition to marine fixtures, railroad lighting material of all descriptions is manufactured; burners, lamps and lanterns, with all the glassware necessary in endless variety are also handled. This department is in charge

Old Improved

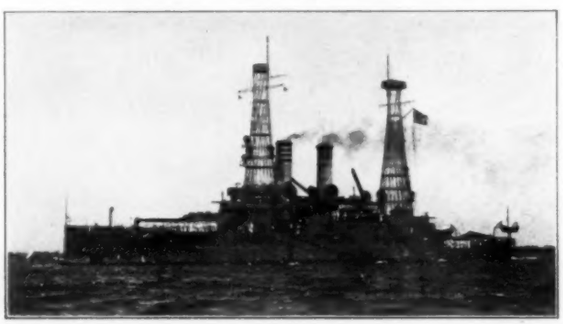
HITCHCOCK LAMP.

of A. D. Hobbie, the genial vice-president and assistant treasurer of the concern, through whose influence and energy it is assuming very large proportions. Nearly all of the great railroads of the United States and foreign countries, especially Canada and South America, are direct consumers of the goods of the Lovell manufacture.

Here is also the home of the Hitchcock Mechanical Lamp, burning kerosene, which winds up like a clock, and with its concealed mechanical movement produces a forced draught which obviates the use of glass chimneys. It gives a light steadier than a gas flame, and equal to a 32 candle-power electric light. It is safer than the ordinary lamp, as explosions cannot possibly occur, owing to the fact that the oil vessel is constantly surrounded by a current of cool air, that finally unites with the flame, producing the whitest light of any artificial light known. Although not so well known in the United States, there is a very great demand for it in South America and the far eastern countries, where glass is dear, and with the breaking of a chimney on the common lamp the light would fail. The lamp generates very little heat. All of the features mentioned make it a very successful light for warm countries.

The company is advertising it extensively in the United States, and the increasing demand for it shows its increasing popularity. It is very useful in isolated places, and has also come to be a part of every summer camping outfit, for by its use the light necessary and also the cooking can be accomplished with a heater that accompanies it.

A large brass foundry with modern improvements, where brass and bronze castings are produced on a commercial scale for outside consumers, is a part of the plant, together with a white metal department, where slush and solid mould castings are produced from antimonious lead in endless variety for the lamp novelty and art metal goods trades. With the various lines of manufacture this concern will undoubtedly prove a very large addition to the varied manufacturing industries located very closely to the commercial center of the city of New York.



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BATTLESHIP "MISSISSIPPI," BUILT AT CRAMP'S SHIPYARD, PHILADELPHIA, PA.

A list of the vessels that have been equipped with fittings by the Lovell company follows:

BATTLESHIPS.

Georgia	St. Louis	Wisconsin
Vermont	Chester	Ohio
Mississippi	Salem	Maryland
Alabama	Minnesota	Tacoma
Maine	Louisiana	Minneapolis
Washington	New Hampshire	Arkansas
Birmingham	Kentucky	Connecticut
Missouri	Idaho	Florida
Virginia	Hancock	Wyoming
Rhode Island	Tug Markeeta	Utah.
Kearsarge	New Jersey	

CRUISERS.

Pennsylvania	Charleston	Tennessee
West Virginia	Colorado	Montana

TORPEDO DESTROYPRS.

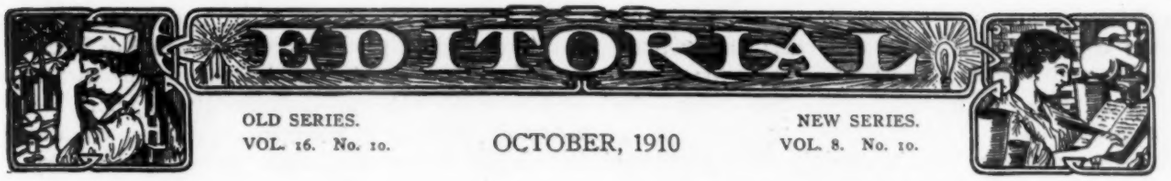
Ammen	Patterson	Terry
Burrows	Roe	Walke
McCall	Sterell	

SUBMARINES.

Thrasher	Salmon

Besides numerous merchant and passenger ships.

Newly issued catalogues of United States navy standard fixtures and wiring appliances, also for commercial marine fixtures and railroad supplies, can be obtained by sending a business card to the firm's address in Arlington, N. J.



OLD SERIES.
VOL. 16. No. 10.
OCTOBER, 1910
NEW SERIES.
VOL. 8. No. 10.

THE METAL INDUSTRY

THE CONSOLIDATION OF
THE ALUMINUM WORLD
THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS' REVIEW
COPPER AND BRASS

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CONTENTS

	PAGE.
The Casting of a Manganese Bronze Propeller Wheel	409
Some Common Defects Occurring in Alloys	413
Making Russian Samovars	416
Price of Radium	416
The Electric Extraction and Refining of the Non-Ferrous Metals (Concluded)	417
The Production of Brown of Bronze Barbedienne Tones by Immersion	418
Platinum as a Useful Metal	419
On Magnetic Alloys Formed from Non-Magnetic Materials	420
The Gun Metal Finish on Steel	424
Duralumin, A New Alloy	425
A New Automobile Castings Foundry	426
Where the Marine Lighting Fixtures Used by the United States Government Are Made	427
Editorial:	
Alloys and Aviation in England	429
New Book Catalog:	
Yale & Towne Manufacturing Company—Hardware Catalog	430
Criticism and Comment:	
American Ownership of the M. R. V. Furnace	431
The Inventor of Duralumin	431
Shop Problems	431
Patents	433
Industrial:	
Four Slide Wire-Forming Machine	434
Bliss Sheet Metal Working Machinery	435
The Riehl Wheel Brushes	436
Bayer Combination Squeezer and Roll-Over Machine and Bayer Match Plate Composition	437
The Ideal Furnace	438
Various Finishes in Lacquer Enamels	438
Steven's Ring Buffing Wheel	439
Corcoran Tank for Chemical Solutions	440
Associations and Societies	440
Personals	441
Correspondence	442
Trade News	445
Metal Market Review	448
Metal Prices	449

ALLOYS AND AVIATION IN ENGLAND.

We present in the lines following some ideas, written from the English standpoint, regarding the use of non-ferrous alloys in the manufacture of air ships. As noted in the September number of THE METAL INDUSTRY several articles on this subject have been published from time to time in this journal, the principal one appearing in the issue for August, 1909. That article gave a general idea of what had been done in the way of utilizing metals in the construction of air ships. The following article deals with a description of alloys which, if primary tests prove conclusive will go far towards furnishing the ideal metal for aviation purposes.

—

Will there ever be put upon the market an alloy as light as aluminum, as ductile as lead, and as tenacious as steel? Or is such a one in the same category as the philosopher's stone? The slow evolution of alloys is continually and irresistibly forwarded by the labors and research of individuals and committees, some acting upon their own initiative, others assisted by the funds of a government, a university, or by the munificence of a public-spirited citizen.

Daily the future analyst, research student or professor receives his training in the metallurgical laboratories of the great universities and colleges, and in a lesser degree in the well-fitted technical schools of our larger cities. It is not unreasonable to hope, therefore, that the discovery of an alloy combining extraordinary strength with lightness may be announced to an expectant world, to the rich rewarding of its discoverer.

In his search for such an alloy the inquirer naturally turns towards the lightest and most abundant of metals—aluminum. For an account of the systematic exploration of its possibilities, when alloyed with other metals, we commend to the attention of our readers the Ninth Report to the Alloys Research Committee, by Dr. W. Rosenhain and Mr. F. C. A. H. Lantsberry, of the National Physical Laboratory, Teddington, copies of which may be obtained from the Secretary of The Institution of Mechanical Engineers, Storey's Gate, W.

We do not pretend that this report has solved the question of how to make a light, strong alloy; we merely take one or two examples from it to show in what an exhaustive manner certain combinations of metals have been forced to yield up their secrets, and to augur from it the successful application of the same profound science and skill to the requirements of the art of aviation.

It was intended by its authors that the ninth report

should include alloys of copper, aluminum and manganese; copper, aluminum and nickel; and copper, aluminum and zinc, but, the field proving too extensive, their labors were confined to one group—the first-named.

"A large number of data of direct practical interest have been accumulated, particularly as regards the mechanical properties of some of these alloys," say the authors; a claim which will readily be admitted as justifiable.

It was discovered that one of the most noteworthy properties of the alloys of high copper contents is their resistance to abrasion. Tests made upon alloys containing from 9 per cent. to 10 per cent. of aluminum, and 1 per cent. to 3 per cent. of manganese, the balance being copper, revealed an extraordinary degree of hardness; while the test pieces submitted themselves quite readily to the turning tool. In their resistance to abrasion these alloys showed results which place them considerably above tool steel, and the report proceeds to say: "Under loads which would immediately indent and destroy any ordinary bearing metal, rings of these alloys have been run for a large number of revolutions with only an appreciable amount of abrasion."

In Stanton's rolling abrasion testing machine a ring of rail steel lost in weight 64½ milligrammes, a ring of tool steel 27 milligrammes, and a ring of an alloy composed of copper 88 parts, aluminum 9 parts, and manganese 3 parts, only 10 milligrammes, under identical test conditions.

Here, then, is given to the world an alloy worthy the attention of practical men, as peculiarly suited for bearings for high-speed engines, and general fittings and castings required for motor car, motor boat and aeroplane construction. Nor is it less adaptable for marine purposes, where in the form of condenser plates, condenser tubes, pump glands, sleeves, and so forth, the naval engineer would extend the heartiest of welcomes to a metal upon which sea-water has apparently no corrosive action.

The foregoing insufficiently outlines the results of patient investigation and research; it is by these means that new alloys are produced and fresh fields for business enterprise thrown open.

Probably to many of our readers the details of the Ninth Report are already familiar, or they have at least extracted from it such information as may be of importance to them. But it is to those who specialize, and in particular to those whose foundries and workshops supply the ever-increasing demands of the automobile and kindred trades, that we now address ourselves. As was outlined in the editorial of our birth-number—in August of last year—it is our object to keep the manufacturer in touch with every new development and process and to assist him in capturing new business and extending his already established lines. To such we would commend a close study of the requirements of aeroplane builders.

That the aeroplane has come to stay, and that its extraordinarily rapid evolution is a proof of it, cannot be gainsaid. Already, in spite of our backwardness as compared with our Continental neighbors, a considerable business is springing up in this country, in the supply of metal eyebolts, sockets and sundry fittings comprised in the fragile-looking framework of the flying machines with which many have made themselves familiar at one or other of the aviation meetings that have been held in this country. But in the first eight months of the current year no less a sum than £43,000 represents the value of imports under the heading of "Aeroplanes, Airships, Balloons and Parts," all of which could have and should have been made by British hands.

In an attempt to forecast the future, John B. Moissant, the first man to fly from Paris to London, confidentially predicts an all-metal aeroplane, and speeds of 100 miles an hour. Obviously there is no room here for such flimsy wing-material as the canvas now in general use; wings will be sheathed with an aluminum-like alloy, incorrodible and weatherproof. Frame and fusellage will no longer be fashioned—little better than a boy's kite—with wood and wire; square or round tubes, or girder-shaped sections of our ideal alloy will provide the rigidity and resistance necessitated by the enormous strains set up in driving a weight of anything up to 2,000 pounds through the air at 100 miles an hour.

Much steady, considered work is now being done to place Great Britain in the forefront of aviation. In the hands of a Royal Commission is the study of many scientific problems connected with flight. Private firms and individuals are expending time and substance in practical experiments. Will the metal manufacturer be ready to supply material—strong, light and malleable—suitable for the purposes we have indicated, when he is called upon for it?

A NEW BOOK CATALOGUE

Yale and Towne Manufacturing Company Catalogue No. 20. Size 12¼ by 11¼ inches, 915 pages, over 4,000 illustrations. Bound in green cloth with red leather back. Issued for the use of the hardware trade by The Yale and Towne Manufacturing Company, New York and Stamford, Conn.

Introductory Section, Customary Indexes, and brief interesting articles regarding Padlocks, Locks and Latches, Door Checks, Miscellaneous Hardware arranged by Schools, and Cabinet and Trunk Locks.

The company's line of padlocks, and locks and latches, is perhaps the most extensive made and extends to page 275. The new Yale turret locks, specially constructed for use on fireproof doors and employed in this company's recent contracts for the Metropolitan Tower, the Fifth Avenue Building and elsewhere, are interestingly described with elaborate illustrations on pages 259 to 264.

An important improvement in the illustrations consists in showing various types of locks and miscellaneous hardware as in use. This applies not only to such items as locks and latches (which are shown mounted on a sample board prepared like an actual door), door checks, etc., but to casement adjusters. The book is from the press of the American Bank Note Co., who make a specialty of large books of this character and both they and the Yale & Towne Mfg. Co., are certainly to be congratulated on the production of a volume of the highest possible grade.

AMERICAN OWNERSHIP OF THE M. R. V. FURNACE.

To the Editor of THE METAL INDUSTRY:

My attention has been called to certain remarks made by various parties relative to the ownership and sale of the M. R. V. furnace. I wish to here make the statement that I am not, and have never been financially interested in any way with the M. R. V. furnace, and that I have not received any money for any transaction made in connection with these furnaces. I wish also to make this statement for the Nathan Mfg. Co., who have also been quoted as being financially interested in the furnaces. None of the members of the firm are, or have been connected in any way with the M. R. V. furnace.

The above statement having been made by outside parties, is probably due to the fact that the Nathan Mfg. Co., tried out the first furnace shipped from England, and as it was successful, a battery of them were installed, and also by the fact that many inquiries have been made directly to the Nathan Mfg. Co., and to the writer of this article, for information regarding the operation and manipulation of these furnaces. For such information as has been given, neither the Nathan Mfg. Co., or the writer should be taxed as being connected in any way financially with the sale and operation of these furnaces, and if the statements are still continued in by certain parties, it will be necessary to take some means of stopping them.

W. L. Abate,
Nathan Manufacturing Company.

New York, Oct. 8, 1910.

THE INVENTOR OF DURALUMIN.

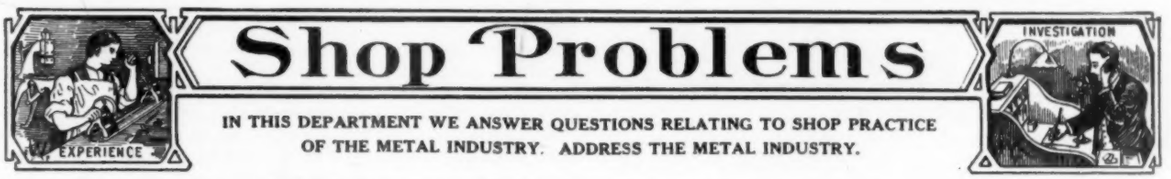
To the Editor of THE METAL INDUSTRY:

Your letter of the 8th inst., has been forwarded to me here, and I am much obliged for the interest you have displayed regarding "Duralumin." The association of my name with the invention is due either to a misunderstanding or else sheer imagination on the part of the newspaper people. "Duralumin" is the invention of my friend, Herr A. Wilm, who is as much amused as I am annoyed at the newspaper reports.

Herr Wilm knows me too well to think that I have had anything to do with the rumor or statement that I was the inventor; all that I said was that "in the course of investigations we had come across 'Duralumin' and thought so much of it that we had determined to manufacture it on a large scale!" The properties of the alloy have *not* been exaggerated in any reports I have seen and I anticipate that the material will soon be well known all over the world. For any further particulars regarding samples and properties, perhaps you will be good enough to address the German agent, Herr L. M. Cohn, 8-9 Passauerstrasse, Berlin, W. 50, who will, I am sure, be only too happy to corroberate what I have said on behalf of both Herr Wilm and Herr Krautschneider, (who is Wilm's partner in the matter), and through whom Messrs. Vickers' Sons & Maxim, Ltd., have carried on all negotiations in connection with the alloy.

H. D. Weeks,
Chemist, Vickers' Sons & Maxim, Ltd.

Paris, France, Sept. 22, 1910.



ALLOYING

Q.—Kindly let me know the alloy of a white metal which will stand brazing and that will also silver plate well.

A.—The alloy called "Aluminum-Silver" casts well and will stand brazing. Its formula is:

Copper	57%
Nickel	20%
Zinc	20%
Aluminum	3%

The best results are obtained with this metal by melting it twice.—J. L. J.

Q.—Will you please inform me if nickel steel would be a good metal out of which to make a ground key cock, which is to be used entirely in cold water, and must not leak?

A.—We would advise you to use the following alloy for your ground key cock:

Copper	88
Tin	10
Zinc	2

You would find monel metal a good alloy for your purpose, but the cost of grinding it would be high. Nickel steel would be unsatisfactory, because it will rust unless very high in nickel, and even 30 per cent. nickel often corrodes because of imperfect alloying of the steel and nickel.—J. L. J.

BRONZING

Q.—Will you kindly publish a reliable formula for steel (dark) or nearly black bronzing on brass and necessary quickener?

A.—For a dark steel formula proceed as follows: Dissolve in each gallon of commercial hydrochloric acid two pounds of powdered white arsenic. This should be accomplished by the aid of heat. After the arsenic is all dissolved add four ounces of single sulphate of nickel to each gallon, and one-half ounce of sulphate of copper. Use the solution cold with anodes of cast nickel with a low current of two or three volts tension. The articles must be chemically clean. It is also advisable to quicken them in a regular nickel bath, which should be only a flash of a few minutes' immersion. The solution gives good results on acid dipped surfaces of brass, copper or bronze. A polished surface will give a dark steel surface. It is not necessary to repolish the surface. A good deposit can be obtained in five to ten minutes. The surface should be afterwards lacquered to protect it from atmospheric influence.

CASTING

Q.—Can you give me a good formula for making nickel bronze castings for valves?

A.—A bronze that has quite a reputation in England for the class of work you mention is known by the name of Filzer bronze. Its analysis is as follows:

Copper	76.72
Tin	8.62

Lead	10.94
Nickel	2.56
Iron	1.06
Phosphorus	0.024

J. L. J.

CLEANING

Q. Will you please tell us how we can remove emery from felt wheels? A. (1) Put the wheels on the machine the same way as if for polishing. Use lump pumice to remove all grease or oil, then use a piece of carborundum, about No. 16, or a piece of old emery wheel of some coarse grit. Carborundum is to be preferred, as it cuts better and quicker and is not so liable to burn the felt. Hold the carborundum or emery wheel against the surface of the wheel while it is in motion until all emery is removed, using a medium pressure and moving the carborundum brick from one side of the wheel to the other, as if the carborundum is held in one place it will burn the wheel.

(2) A felt wheel may be washed off when emery is to be removed in two ways as here described. First: It may be washed off like a leather-covered wooden wheel, if one has the rollers for this purpose, but it must be watched closely so as not to leave it on the rollers too long, for if it does the wheel will become water soaked and this will ruin the felt. The wheel must be taken off of the rollers as soon as the emery and glue are soaked enough to come off, and put on the polishing machine at once, so as to throw all the water off. When it is perfectly dry it may be trued up with a buff stick and sandpaper. Second: Hold a piece of lump pumice against the surface of the wheel to remove all grease or oil. Then put a vessel of water directly under the front of the wheel so that it will catch all superfluous water while applying the water to the surface of the wheel with a piece of waste. The wheel should be kept revolving, using a moderate pressure with the waste and water alone a couple of times. Then apply a piece of brick or lump pumice below the waste and water, holding the waste in one hand and the brick or pumice in the other until all the emery and glue is removed; this is the most economical way of cleaning a felt wheel, as you do not waste any felt. After you have removed all the glue and emery let your wheel revolve while cleaning up the mess, and then use a piece of sandpaper to smooth off the face of the wheel.—T. C. E.

COLORING

Q.—We are mailing you a part of a fixture and ask that you let us know through your Shop Problems columns the process for getting this finish.

A.—The color submitted to us known as architectural bronze. This is produced on brass by the following method: Polish the articles to a cut down or Tripoli finish (a high lustre is not required. Then cleanse in the usual manner and scratch brush wet. Then immerse in a solution of sulphuret of potassium and water at 180 degs. Fahr., using 2 ozs. of the sulphuret to each gallon of water. Immerse for a few seconds, then remove, wash in cold water and dry out by the aid of hot water and finally in maple sawdust.

The color should then be a dark orange without lustre. Now scratch brush the articles dry, using a very soft brass wire brush or one that has been in use for some time. The color should then be correct.

This color is also produced by preparing the surface as mentioned, then copper plating for a few minutes in a cyanide copper solution. Next immerse in a very dilute and cold solution of sulphuret of potassium, about 1 dwt. to the gallon of water. This will give a brown tone to the copper. Then wash and finish as above. Lacquer in the usual manner.

If the first formula is used and the color is required to be a little darker, then use a very dilute solution for the purpose of a second immersion after the first scratch brushing. This must be accomplished rapidly. The correct solution will contain about 4 ozs. of the hot solution to a gallon of cold water. After the second immersion dry out as described, but do not scratch brush again. This is only a toning solution. Finally lacquer with a good body lacquer.—C. H. P.

PLATING

Q.—Will you kindly tell me why my nickel plated discs, which are made of zinc and tin, go black and streaky after they have been in the vat for some time; also the best method for plating same?

A.—The trouble you experience with black or streaky deposits on zinc and tin is due to the acidity of your bath and a low conductivity. To overcome your trouble, add one ounce of carbonate of nickel and two ounces of sal ammoniac to each gallon of solution.

For plating zinc and tin exclusively the following formula gives excellent results:

Single sulphate of nickel	10½ ozs.
Potassium citrate	7 ozs.
Sal ammoniac	10½ ozs.
Water	2½ gals.

The solution should be maintained neutral, which can be accomplished by occasionally adding a few ounces each of potassium citrate and sal ammoniac to a fifty-gallon bath.—C. H. P.

Q.—Please tell us what is the matter with our Hawkins gun metal solution. It plates dark gray instead of black.

A.—The formula given by Mr. Hawkins in his work on Polishing and Plating is supposed to be reliable. If the solution does not give good results it may be due to the reason that the arsenic is not taken up by the solution. Try dissolving two ounces of arsenic in four ounces of caustic soda and a pint of boiling water, then add to your solution. This will probably give you a blacker tone. We suggest that you use anodes of sheet brass and a low current; too strong a current deposits too much nickel, which produces a gray tone.—C. H. P.

SOLDERING

Q.—Please inform me as to what is the cheapest metal for badges to be either hard or soft soldered, where to buy it and the price.

A.—The metal principally used in manufacturing badges that have to be hard soldered is known as gildine metal, and can be procured from any well-known brass manufacturer. Small quantities can only be obtained through a jobber. This metal, when finished by the usual acid dipping or polishing methods gives the appearance of a gilt finish. A number of other metals are used for the purpose mentioned, such as britannia metal and antimonial lead. But such metals cannot be hard soldered, and have to be electroplated to give a finish. You would be unable to mix the gildine metal yourself. It comes in sheets of any specified thickness.—C. H. P.

SPOTTING OUT

Q.—I wish to ask you if you have any remedy for brass spotting up on soft, porous, malleable iron castings, also on porous bronze castings. I have had trouble with the plating solution coming out after the goods are finished, and leaving brown spots on them. Do you know any remedy for this?

A.—Many remedies have been proposed to overcome the difficulty you experience, but many of them have failed to give satisfactory results. One of the following methods should overcome your difficulty.

1st.—Try boiling out in a solution consisting of 2 ounces of sodium sulphate to each gallon of water for 5 to 10 minutes, then plunge in cold water, reimmerse for a few minutes more in the boiling solution, then wash and dry out in the usual manner.

2nd.—Boil out in a platers' compound solution 2 to 4 ounces to the gallon, then place in heated seasand to absorb all the moisture in the pores of the metal.

3rd.—Boil out in a platers' compound solution, then allow each day's work to accumulate for a week, if possible, then take the first day's work and pass through a bright acid dip as quickly as possible, wash and dry out, and so with each succeeding day so that there is always a week's accumulation ahead. This is the method used by a large malleable iron concern who do their own plating and finishing, especially on such goods as clock and picture frames. This method probably surpasses any other when carried out systematically, but either method should give results.—C. H. P.

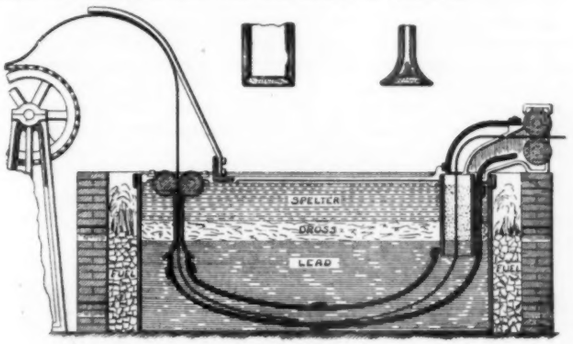
PATENTS

REVIEW OF CURRENT PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

969,392. September 6, 1910. Galvanizing Apparatus. Alexander Niedringhaus, St. Louis, Mo.

As shown by cut, this is a new apparatus for galvanizing iron or steel.

In the galvanizing of plates where molten lead is used in the bath a flux box is also used, through which flux box the sheet to be galvanized is passed prior to its introduction into the molten lead bath. Great difficulty has been experienced in the use of these flux boxes because the metal of which they are composed burns out at the lower portion, or is eaten away, so that spelter and dross enter and the flux escapes into the kettle. The boxes, therefore, have to be frequently renewed. In introducing a new box into position the lower open end of the box will trap a quantity of the spelter and dross, which in practice has had to be ladled out after the box was submerged in position.



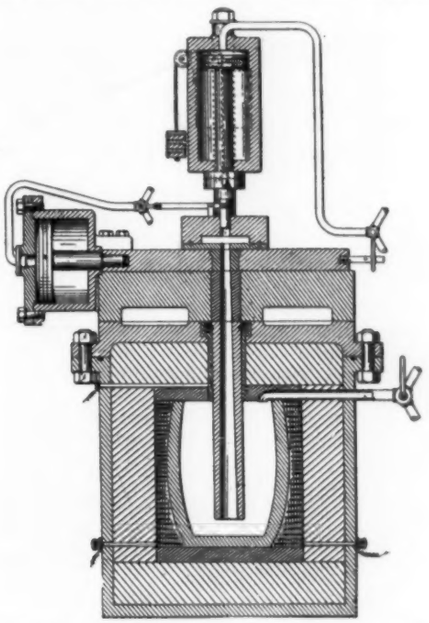
It has been found to be impossible, however, to ladle out all of the spelter and dross. The object of the flux box in excluding the spelter and dross is to enable the sheet, after passing through the flux box, to be first treated in the lead bath, where it is heated to the proper temperature and thus made in readiness to receive the coating of zinc, which more readily adheres to the heated plate, and the plate being of an even temperature throughout, will partake of an even coating of zinc.

The present invention consists in the provision in a flux box of means to exclude spelter and dross in submerging or partially submerging this box in position. This means in the present instance consists of a breakable bottom wall made of some frangible material, such as cement or plaster-of-paris, so that it may be broken when the box is inserted in position to permit the introduction of molten lead into the lower end thereof to the exclusion of dross and spelter, in the instance of the flux box, and to the exclusion of dross in the instance of the box at the discharge end of the tank.

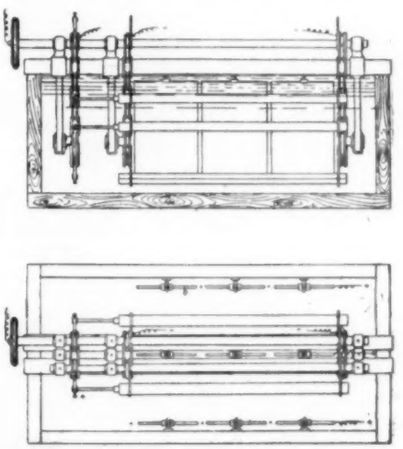
969,539. September 6, 1910. Casting Apparatus. F. T. Ketchen, New York, N. Y., assignor to Compressed Metal Company, New York.

This invention relates to apparatus shown in cut for the rapid casting of metals in hard molds, and while the improvements hereinafter described have been devised with special reference to the casting of the less readily fusible metals, such as brass, for example, they are nevertheless applicable with advantage to the casting of the more readily fusible metals and alloys.

The principle object of the invention is to provide improved means whereby the metal in the mold may be subjected to a high pressure until it has cooled, thereby producing a casting of thoroughly homogeneous character, conforming exactly to the configuration of the mold. Heretofore the molten metal has sometimes been forced into the mold by a plunger submerged below the surface of the molten metal in the melting pot, but the subjection of the pump to the action of the molten metal is greatly destructive of the pump. In other cases the molten metal has been forced into the mold by air or gas pressure on the surface of the molten metal in the melting pot or pressure pot, but such pressure is elastic and is not always efficient. In accordance with the present invention, air or preferably a non oxidizing or deoxidizing gas under pressure, may be employed for the purpose of forcing the metal into the mold, but thereafter, communication between the interior of the mold and the melting pot being closed, the metal in the mold itself is directly subjected to the heavier pressure of a plunger which acts directly upon the metal in the mold.



970,149. September 13, 1910. Apparatus for Galvanizing Metal Tubes, Rods, etc. F. Werth, Milan, Italy.



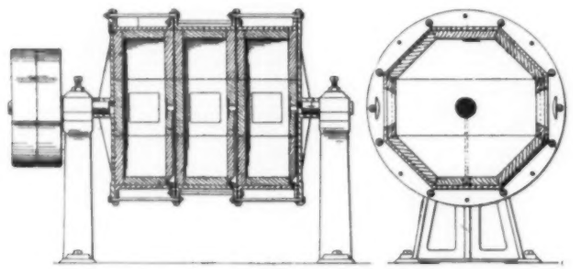
This invention has for its object an apparatus shown in cut for galvanizing metal tubes, rods and the like, either on the surface alone or both on the inside and outside of tubes.

By means of this apparatus important advantages are obtained: 1. An economy of space, because increasing the depth

of the tank presents no difficulties, while any increase in the size of a disk apparatus necessitates lateral extension and consequently complete alterations of the tank and chamber. 2. An important increase in the output of the plant without the necessity for more space, so that any installation can be run for years with the same plant. 3. The larger the plant the more convenient the operation, as the installation of the baths remains the same, the only difference being that more workmen are required.

970,977. September 20, 1910. TUMBLING BARREL. Geo. E. Abbott, Hartford, Conn., assignor to the Globe Machine & Stamping Company, Cleveland, Ohio.

This invention relates to tumbling barrels, and more particularly to the class in which a solution may be used in conjunction



with the articles to be treated, so that the latter may be burnished or have a high polish imparted, which result is attained by the employment of polished steel balls of different sizes so as to adapt the work to be touched and burnished in even the smallest crevices or depressions.

The invention has for one of its objects the provision of an apparatus shown in cut of this nature which might be termed elastic, or in other words, which may consist of one or a plurality of interchangeable sections which may be removed at will, or to which more sections can be added as required.

A further object of the invention is the provision of means whereby each one of the sections may be independently vented and in such a manner that no intermingling between the solutions contained in a pair of adjacent sections can occur, the venting feature being essential inasmuch as by it all excess of pressure which may be established by the vaporization due to the churning of the solutions during the rotation of the barrel may be carried off, and all danger of bursting due to such pressure be entirely avoided.

971,085. September 27, 1910. JOURNAL BRASS. H. J. Small, San Francisco, Cal.

This is an improved composite bearing for carbox axles. The journal bearing is formed of a backing member, which is, for the sake of economy, made of malleable iron; and a journal bearing member which is composed of the "brass" of customary bronze composition, a filling of some softer metal, as Babbitt, and an inner lead lining.

The brass is grated, and into these the Babbitt metal is poured and fills them. The lining covers the inner surfaces of the brass and Babbitt.

In order to hold the two members—namely, the outer backing and the Babbitt-filled and lead-lined "brass"—together and prevent relative movement either longitudinally or circumferentially, the adjacent or contiguous surfaces of the two are circumferentially complementally corrugated, which corrugations, interengaging or fitting each other, prevent endwise relative movement; and also on the surface of one of these members, here shown, as on the backing member, are made longitudinal ribs which fit in corresponding longitudinal grooves in the other member, which interengaging ribs and grooves prevent crosswise or circumferential relative movement.

INDUSTRIAL

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

MANVILLE BROTHERS' FOUR SLIDE WIRE-FORMING MACHINE.

In the machine here illustrated the manufacturers, Manville Brothers Company, designers and builders of wire and metal working machinery, Waterbury, Conn., have paid especial attention to the convenience of handling all adjustable parts, and have succeeded in so arranging them that the operator may stand at the front of the machine and reach his clutch lever, wrenches, and the adjustments of straightener, feed, cut-off, former, tools and stripper. It is evident that such an arrangement means a minimum loss of time and maximum output.

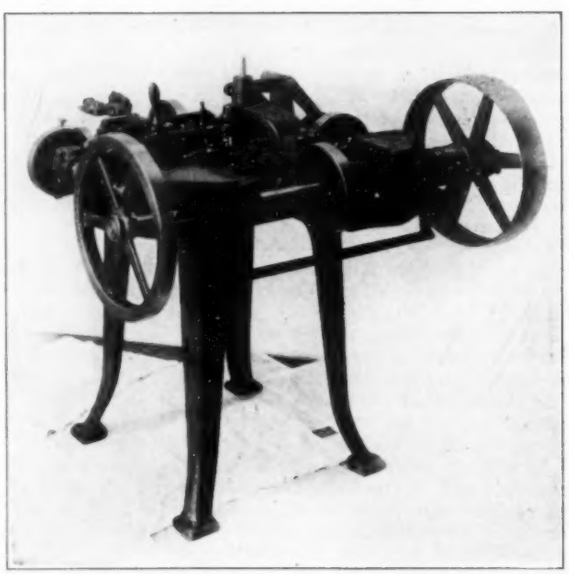
WIRE STRAIGHTENER.

This is of the well-known double-roll type, and so placed that the operator may see the wire at all points as it passes between the rolls.

WIRE FEED.

In the original machine of 1854 the feed is operated from a crank plate on the end of the side shaft through rocker arms and connections to the feed slide. This mechanism has proven so efficient that it is used in the latest model with such modifications as the present requirements demand.

There are two adjustments for the feed: a main adjustment at the crank plate, consisting of a binding nut on the crank pin and a knurled adjusting screw for moving the crank pin to and from the center, and an auxiliary adjustment at the top of the rocker arm, which raises or lowers the end of the main connection. The first is used for rougher adjustments, and the auxiliary for refinements in length of feed, not heretofore attainable.



FOUR SLIDE WIRE-FORMING MACHINE.

The feed grip is operated by an independent cam and cross slide, and is so arranged as to handle either wire or flat band

metal. It will be noticed also that the grip lever is so pivoted as to make the grip, in a way, self-tightening. That is, the greater the resistance to feeding, the tighter the grip. This grip lever may be thrown into or out of action by the knurled handle on top of the lever without stopping the machine.

CUT-OFF.

In machines of the older types it has been customary to loosen two cap screws and drive the cut-off bracket to as near the correct position as possible for the length of wire required. Realizing that such methods would be out of place when used in combination with the refinements of feed adjustment, the bracket is adjusted with a screw and mitre wheels. With this arrangement the operator, with one wrench, may loosen the clamp bolt and turn the screw adjustment until the cut-off is in the correct position, giving a degree of accuracy corresponding with that of the feed.

SLIDES.

These are well fitted and scraped to a bearing, and are supported by projecting shelves extending from the edge of the bed, thus supporting them against the downward pressure at the cam rolls. Further information can be had by addressing the Manville Brothers Company, Waterbury, Conn.

E. W. BLISS COMPANY'S SHEET METAL WORKING MACHINERY AT THE BRUSSELS EXHIBITION.

The center of attraction at the Brussels Exhibition to manufacturers of stamped articles and sheet metal goods was undoubtedly the stand of the E. W. Bliss Company, Brooklyn, N. Y. (Paris branch). This firm showed an even larger and more varied collection of machines than at the Franco-British Exhibition in 1908.

Among many novel and interesting tools, the one which first took the attention was a very large hydro-mechanical press, shown in Fig. 1—a tool which introduces an entirely new principle into manufacturing methods. Its pressure capacities range from 20 to 600 tons, and it combines the sustained and powerful "squeeze" of hydraulic action with the speed and accuracy of a merely mechanical press. The pressure is controlled by a safety valve and may be limited to any desired point between 20 and 600 tons. The mechanical and hydraulic motions are quite distinct. As soon as the clutch is thrown in the toggle straightens out so that the punch comes to within almost touching distance of the piece to be worked, and at that moment the hydraulically actuated die-bed effects the working pressure on the blank, rising the short distance required to accomplish the squeeze, then returns, while the punch is quickly raised to its starting position.

FIG. 1—No. 600 H M "BLISS" HYDRO-MECHANICAL PRESS (A. Wilzin's Patent), Pressure 600 Tons.

The entire cycle takes less than three seconds, and 20 strokes per minute may thus be utilized. The press operates without vibration shock or noise, so that it may be placed on an ordinary solid shop floor, thus obviating the heavy cost of foundations necessary for drop-stamps, heavy screw-presses, etc. It cannot get wedged, sprung or broken by introducing blanks too hard or thick, and once set, any lad or woman can work it with ease. The smooth but powerful and continued pressure of this machine permits of obtaining results in a single "squeeze" which otherwise call for seven or eight operations and annealings, the action of the press causing the molecules right through the metal being worked to flow into the shape of the dies, instead of acting on the surface alone, as is the case with drop-stamps and screw-presses, etc. The manufacture is, therefore, much more rapid, not to speak of the elimination of annealings. In

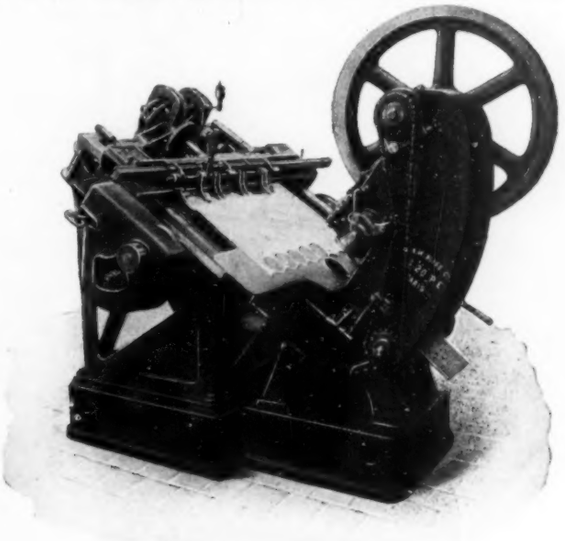


FIG. 2—NO. 2) P E "BLISS" ZIG-ZAG PRESS (A. Wilzin's Patent) for automatically cutting and stamping bottoms, boxes, etc.

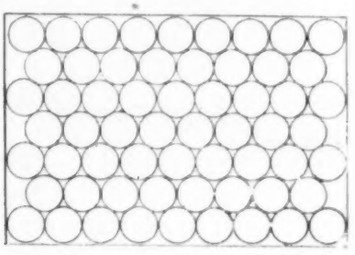


FIG. 3—METHOD OF BLANKING WITH ZIG-ZAG PRESS.

addition, this machine is easier on the dies than mechanical presses, and the dies last much longer.

The firm showed a whole line of machines—many highly novel for every phase of tin-can and box manufacture. The

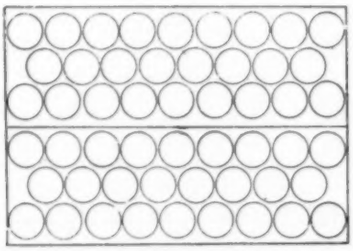


FIG. 4—AN OLD AND WASTEFUL METHOD OF PUNCHING OUT BLANKS.

now well-known "Bliss" top and botton zig-zag stamping presses are exemplified by an automatic and semi-automatic machine. The first, shown in Fig. 2, which is tooled for simultaneously cutting and stamping blacking boxes, takes the full lithographed sheet, which is clamped in the carrier by a single movement,

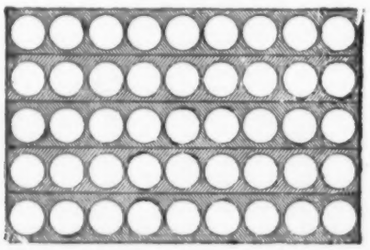


FIG. 5—ANOTHER UNECONOMICAL METHOD OF BLANKING.

and feeds it automatically under the die. The cuts are made in zig-zag, one touching the other as nearly as possible, so that the maximum of economy in tinplate is attained; the finished pieces fall out through the back of the press by gravity, and the scrap, separated from the goods, is cut off in small pieces at every stroke. The press runs at 60 to 100 strokes

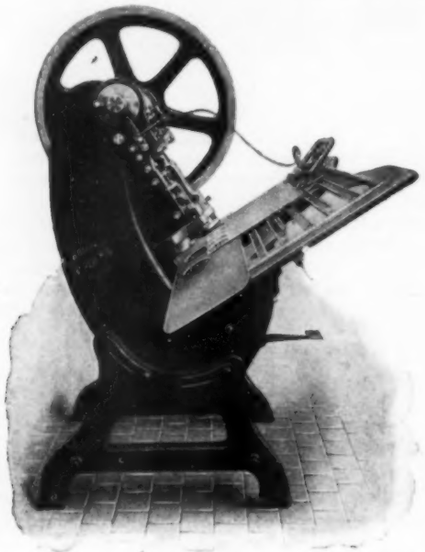


FIG. 6—NO. 20 P S "BLISS" ZIG ZAG PRESS.
(A. Wilzin's Patent), for simultaneously cutting and stamping lids, boxes, etc.

per minute acording to size and shape and the whole operation is automatic, the sheet carrier returning to its original position after the last cut ready for placing another sheet of tinplate. The division is very exact, insuring coincidence between cuts and printing on lithographed sheets, and as one operator can easily attend to two or more machines, the economy in labor, as well as in stock is enormous. Figure 3 shows the advantage of this method over the existing methods 4 and 5, and it is claimed that the saving thus obtained varies from 5% to 30%.

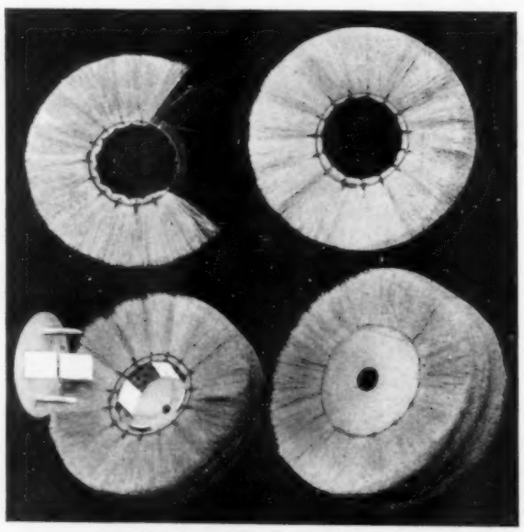
The semi-automatic machine, shown in Fig. 6, which is tooled for lids, works on exactly the same principle, but the sheet carrier is pushed along by hand, being automatically stopped in the right place for each cut. The operation, however, calls for practically no effert on the part of the operator, who once used to the work can catch every stroke of the press, that is to say, from 60 to 100 strokes per minute.

Apart from their great labor and stock-saving qualities, these machines have the great advantage of presenting no possible danger to the hands of the operator, who never has to get them near the tools while the press is in action. The principle of these machines may also be applied with equal success to cupping or drawing articles from sheet brass or other metals, and a similar division table may be fitted to double-action presses.

THE RIEHL WHEEL BRUSHES.

The most recent entry into the field of circular tampico wheels and wire scratch wheels is the Riehl Mfg. Company, located at Cleveland, Ohio. The company is manufacturing a new patented sectional wheel brush, which is rapidly taking the place of the old style wheel brushes.

The accompanying illustration will give the reader a clear idea of the construction of the Riehl wheel. The view in the upper left-hand corner of the illustration shows the strong sheet steel washer and the side rings which hold the tampico in position. The view in the upper right-hand corner shows a completed section; a number of these sections are slipped on an aluminum hub, as shown in lower left-hand corner of illustration. This hub is self-locking and requires no nut to hold it together. A brush of any width can be made with these sections; one section is equal to one-half inch face. In the lower right-hand corner of the illustration is shown a complete wheel brush.



THE RIEHL WHEEL BRUSHES.

Riehl wheel brushes, owing to this method of sectional construction, are claimed to be far superior to the old style wheel brushes, being much more durable and economical. As will be seen in the above illustration, the tampico is laid very close together, making a very firm and substantial wheel, giving the very best results. The wire scratch wheels are constructed on the same principles as the tampico wheels, but owing to the difficulty in handling the coarse wire sections, the wire wheels are made complete, balanced up and finished; they are ready for immediate use. The fine wire wheel brushes are made entirely of metal. There is no waste to these brushes, as they will wear down perfectly even; the wire cannot pull out, and there is no wooden hub to split. Riehl wheel brushes are made in all standard sizes and a full line is carried in stock, ready for prompt shipment.

BAYER COMBINATION SQUEEZER AND ROLL-OVER MACHINE AND BAYER MATCH PLATE COMPOSITION

The J. D. Smith Foundry Supply Company, foundry engineers, Cleveland, Ohio, have taken over the entire business of the Bayer Pattern Plate & Manufacturing Company of Cleveland, manufacturers of the famous Bayer composition for making patterns and match plates, and the Bayer combination squeezer and roll-over machine.

With this machine the entire mold is made in one operation when work of snap flask size is being produced, but on larger patterns, within the capacity of the machine only, the copes or drags are made when the plates are too large to permit of bolting both cope and drag plates to the table.

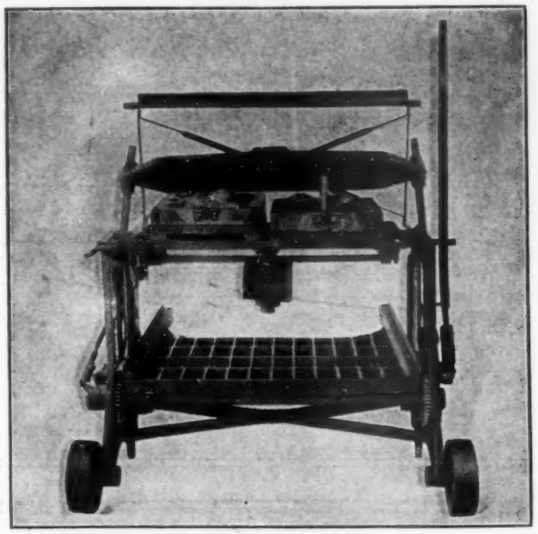


FIG. 1 shows the match plates bolted to the swinging table.

The machine will take a flask 30 ins. long, 22 ins. wide and 9 ins. high, outside measurements. The weight of the machine is 750 lbs., stands 33 ins. high, 50 ins. wide at the wheelbase, and the sliding table has a lift of 8 ins. The machine can also be used for ordinary squeezer work without the roll-over device if desired.

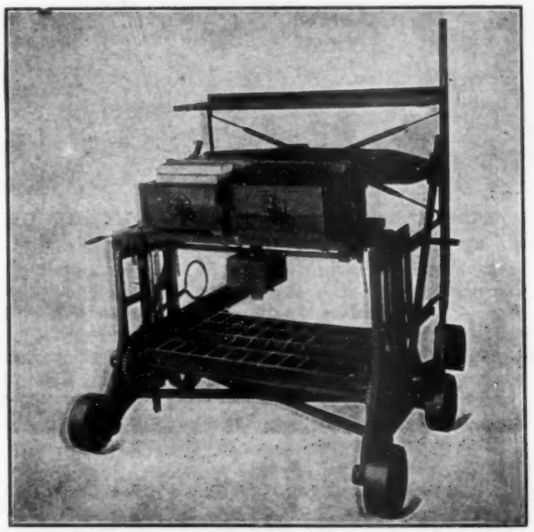


FIG. 2 shows the flasks clamped ready to roll over after being squeezed. The hand lever controlling the movement of the squeezer head is shown at the right.

THE PATTERN PLATE COMPOSITION.

The Bayer pattern and match plate composition is a black composition resembling hard rubber in appearance, and fulfills the most severe foundry requirements; it is non-shrinking, and therefore makes an exact reproduction of the pattern measurements. The composition is much lighter than iron or white metal and slightly heavier than aluminum, and will withstand rapping and vibrating, and can be used with equal facility on molding machines—the bench or floor.

The surface of the composition plate is absolutely smooth, and will not draw moisture, regardless of atmospheric conditions, nor is it affected by ordinary temperatures. It insures sharp definition of edges and corners, and for this reason is well adapted for match plates of ornamental patterns. The cost of a match plate or pattern of this material is 50 per cent. less than metal plates, and is equally as serviceable; besides the material is of such a nature that it can be readily soldered should a plate become broken. Composition plates can be made from any pattern, wood, metal, split or whole. It is held in strong wooden frames, to which is adjusted ears and guides to fit the flasks on which they are used.

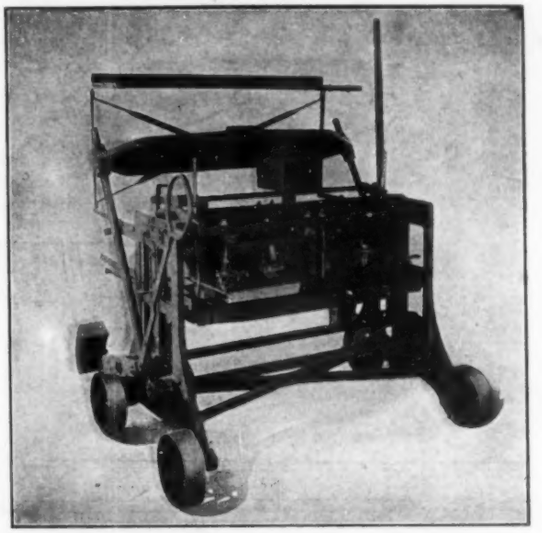


FIG. 3 shows the flasks rolled over; the weight on the bottom of the swinging table counterbalances the weight of the flasks. The sliding table is lifted up to the swinging table by means of the lever at the left.

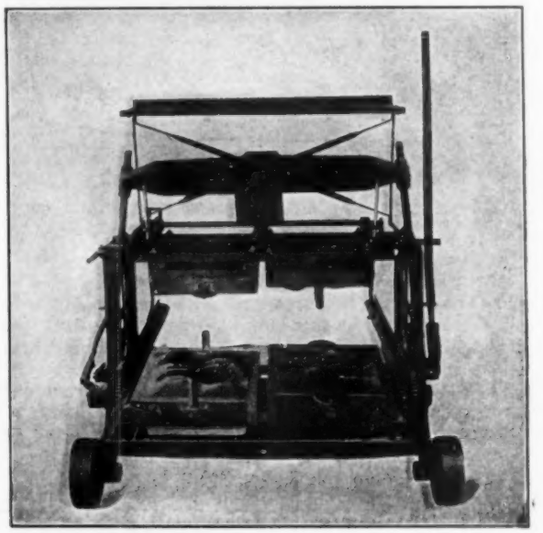
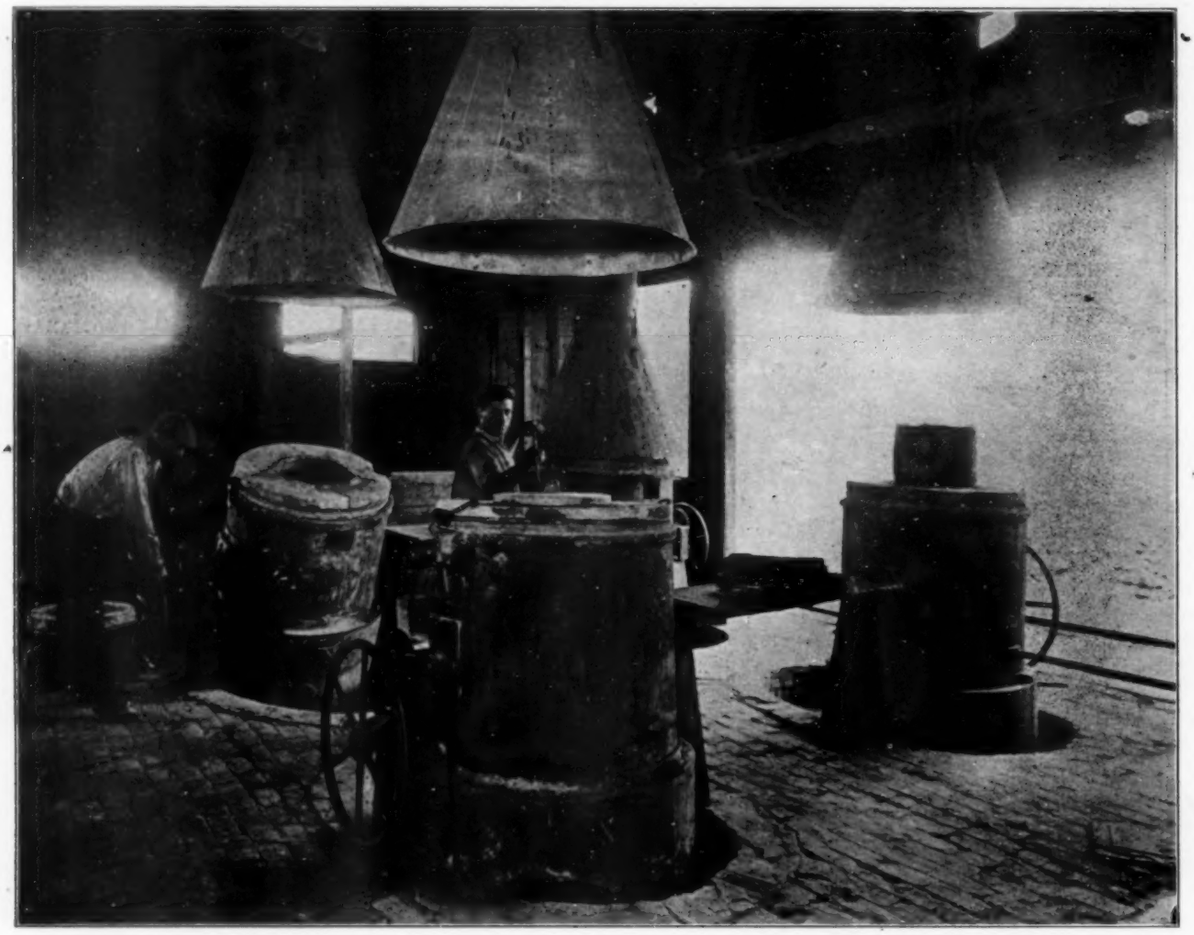


FIG. 4 shows the clamps released, the sliding table lowered, the pattern drawn from the cope and drag halves of the mould.

These plates, it is claimed by the manufacturers, will easily double the daily output of any bench molder. A handy-man using these plates can equal the floors of any molder.

THE IDEAL FURNACE.

The accompanying cut shows a battery of Ideal furnaces at the Duplex Metals Company's plant at Chester, Pa. It also shows the different stages of melting, the telescoping stack which is drawn down on top of furnace after the coke and metal is charged, thus preventing gases and fumes from being carried through the melting room; also the crucible heater which is supplied with fuel from the unburnt coke cleaned from the furnaces. The company report that this furnace is meeting with great success and has been adopted by some of the most conservative foundrymen.



A BATTERY OF IDEAL FURNACES AT THE PLANT OF THE DUPLEX METALS COMPANY, MAKERS OF COMPOSITE METALS, AT CHESTER, PA.

A comparative test, made by the W. S. Cramp & Sons' Ship and Engine Building Company, Philadelphia, Pa., of oil-fired furnaces, pit furnaces and coke-fired tilting furnaces showed the Ideal furnace the most economical of all, and it was consequently adopted. Since the test additional furnaces have been ordered.

The Ideal furnace is manufactured in two sizes, one to accommodate a No. 125 and the other a No. 225 crucible. The only additional equipment needed is a fan. Only one ounce of air pressure is required to melt pure copper ingots, and for yellow brass even this low amount is not needed. The Crown Cork & Seal Company of Baltimore, Md., the Sanitary Company of America, and the A. P. Smith Company, Philadelphia, Pa., and the Utica Fixture Company, Utica, N. Y., are among those who have recently installed batteries of Ideal furnaces. A noticeable point is that wherever the Ideal furnace has been installed a repeat order has always followed. The above firms will be pleased to show the furnaces in operation to all persons interested in same. The furnace is manufactured by The Ideal Furnace Company, Pennsylvania building, Philadelphia, Pa., to whom all inquiries should be addressed.

VARIOUS FINISHES IN LACQUER ENAMELS.

By W. J. Smart.*

In one of my previous articles I referred to the uses of white celluloid enamel, which has for its base instead of oil and varnish a heavy stock lacquer with special gums added to make it suitable for this particular purpose. Since it is free from oil and varnish and has practically a liquid celluloid base it must be water-proof and durable. Unlike paints and varnish it does not grow brittle with age and crack nor does it discolor. It is hygienic and may be washed and scoured without injury. There has always been a demand for white fixtures in numerous trades, particularly for the bathroom. There is a growing demand among architects for this finish for other than bathroom purposes. Paints could be depended upon to turn yellow; they are sure to crack as they grow old and perhaps peel off. Lacquer enamel possesses virtues which make this material particularly suitable for bathroom fixtures, such as seats, tanks, flush pipes, towel racks, cup holders, etc., as well as for chandeliers, builders' hardware and a number of other articles in various trades. It is a material which can be sprayed on and produces a beautiful, even surface, drying with an eggshell gloss. Where the eggshell finish is required it does not take but two coats. Where a polished surface is required of course a number of coats must be applied to stand buffing and the buffing should be done with a rag wheel, not greater than six inches in diameter, revolving at about 500 revolutions per minute, and the articles require very little buffing and must be held very lightly against the wheel. Ordinary cutting down composition is used. The result will be that you will get the exact finish which the article would have if covered with sheet celluloid.

Sea air green and several verde finishes which formerly were a source of trouble to produce, as well as expense, requiring

*Eureka Pneumatic Spray Company, [illegible]

buffing of the article, sometimes plating and always passing through solutions with uncertain results and probably wax brushing afterwards to insure the finish clinging, can now be produced with liquid celluloid by spraying the under shade desired, either dark green, brown, or by mixing colors various shades of yellow green; and, if desired, by the addition of transparent enamel, it may be so applied as to let the metal show through. This is applied on the ordinary surface without grinding or polishing. Will dry in a few minutes and is ready for spraying the verde, which is done with a finer spray held away from the article and may be regulated to give a fine verde film or coarse as desired. An article may be so sprayed as to have the appearance of sand blast finish. In fact the writer has in numerous cases handed samples to some of the best known manufacturers, who immediately pronounced them sand-blast work and in some cases could not convince the manufacturer until he removed the finish and showed the under surface.

Being able to finish an article after it is assembled, as for instance chandeliers, brass beds, etc., is of great value and economy to the manufacturer and will insure a uniform appearance where parts are formed together, whereas when finished separately and assembled they may show a decidedly different tone. Also, chandeliers and brass beds so finished will be free from scratches, and things of this nature can be finished assembled in less time than they can be finished in parts. The material is something which is well worth the careful consideration of manufacturers of metal goods and by its nature cannot be applied to the articles either by brush or dip processes but require compressed air and the air brush. This process is now in use in many hundreds of shops throughout this country and is rapidly being installed in other countries, and makes it possible for a manufacturer to get the benefit of lacquer enamels.

Just at the present time various oriental finishes are popular among the novelty manufacturers. This finish is made by applying the under coat of the desired color all over the article and by the use of the smaller air brush spray on the various colors with shaded and blended effects, merging them into each other so as to present the desired oriental effect. Afterwards give the article a heavy coat of transparent enamel. By the use of compressed air and the air brush and our line of lacquer enamels many novel and valuable effects impossible by other methods can be produced. The Eureka Pneumatic Spray Company, 276 Spring street, New York, the originators of the process and who manufacture the largest line of air compressors, tanks, sprayers, etc., as well as lacquer enamels, are always willing to finish sample pieces if sent prepaid by express and will give instructions to their customers on how to make new and improved finishes in any line of manufacture.

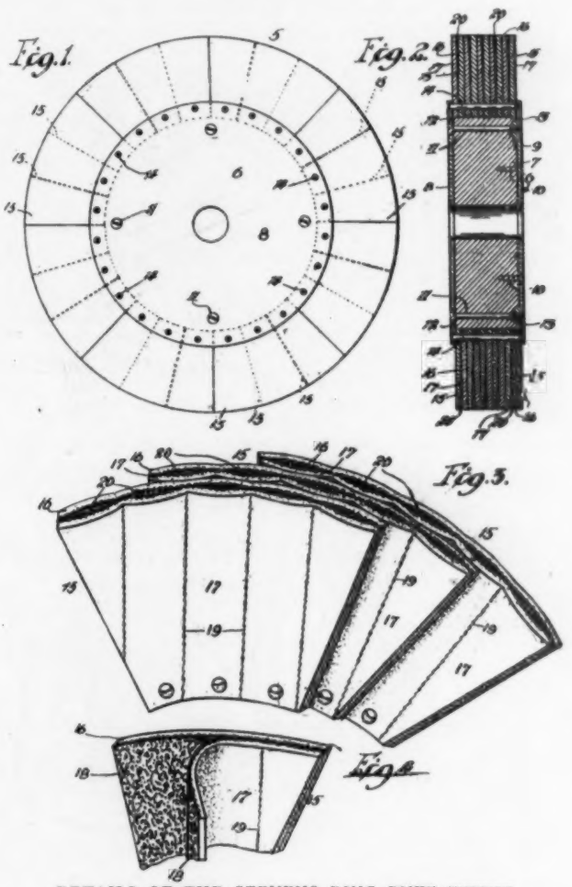
THE STEVENS RING BUFFING WHEEL.

As every user of polishing and buffing wheels knows, there is considerable waste in the average form of wheels. The general form of wheel is such that there is a small wheel or stub left after the polishing life of the wheel has been exhausted. These stubs are thrown away and thus constitute a by no means small item of expense in the operation of buff wheels. Five or six years ago G. P Stevens, of Chicago, Ill., conceived the idea of making a wheel that would be more economical in cost and which would eliminate the waste incidental to the use of the general form of wheel.

As a result of his experiments he produced the ring wheel shown in the cut here reproduced. Fig. 1 shows a side elevation of an assembled polishing wheel of the ring type; Fig. 2 is a cross-sectional elevation; Fig. 3 is a detail view in perspective of the manner in which the polishing units or segments it is proposed to use lie together; and Fig. 4 is a detail view in perspective of a portion of one of the improved polishing segments

Although this wheel has now been in use for some time it is only recently that a patent has been issued upon it. Patent specification No. 968,431, under date of Aug. 31, 1910, covers all the salient features of such a wheel. Briefly described, the ring wheel consists of circular ring of felt, leather or other polishing material, properly mounted on a core or base in such a way that practically all of the polishing or wearing material may be worn away in use before it becomes necessary to renew the wheel. The renewal is effected by simply removing the remaining portions of the wearing material from the base and substituting a new ring of wearing or polishing material.

The principal object of the invention is to provide a polishing body which can be made of any desirable degree of abrasiveness; one which will better retain powders or liquids, thus expediting the polishing operation; one which will permit the use of felt or other polishing materials which have been discarded



DETAILS OF THE STEVENS RING BUFF WHEEL.

after serving a useful life in some other process; and one which will possess a degree of coherence not usually attained in polishing rims built up of a number of distinct units; and also to provide a wheel which does not need to be entirely disassembled for the renewal of the wearing ring.

The inventor says of the new wheel that he took several wheels and distributed them among various users in various parts of the country for trial. The reports all agreed that the wheel would do as represented and was considerably cheaper than the wheels already in use. It was claimed that with the solid feet wheel in use, when worn down to 7 or 8 ins. in diameter, it had to be discarded, while with the new wheel buffing could be done until the wheel was worn to the rim hub an a new ring could be put in in three minutes' time. The ring wheel being made of thin feet, etc., while it cut considerably faster, lasted longer than the solid wheel. It is also stated that one consumer is cutting up the small 8-in. stubs of cotton buff and making a 14-in. ring wheel out of them. In this manner he is reducing his cost for cotton buff wheels about 25 per cent. Full information regarding this new ring wheel may be had by writing to Bennet O'Connell, Stevens Company, Chicago, Ill.

The Canadian Bronze Powder Works, Montreal, Canada, report that they shipped recently one complete carload of bronze powder, weighing some sixteen tons. The management of the works believe that this is the largest shipment of bronze powder ever made in the Dominion of Canada, if not on the American continent. This company also makes aluminum castings.

CORCORAN TANKS FOR CHEMICAL SOLUTIONS.

Platers, galvanizers and others requiring rectangular tanks to contain chemicals will be interested in the product of A. J. Corcoran, Inc., with offices at 1 John street, New York, and factory at Jersey City, N. J. This company has long been known as large manufacturers of round tanks and of late has added to its plant especial tools and fittings for making rectangular tanks in the best manner and by the most improved methods. Each part of every tank is accurately fitted and secured by wrought iron rods passing entirely through the sides and bottom, as shown by the dotted lines on the cut. Wrought iron plates, or cast iron washers, with hardwood timbers, as the case may require, are fitted at the ends of the iron rods and hold the parts of the tank solidly in the groove provided for each. The tanks can be put together and taken apart at will. They are made of cedar, white pine, yellow pine, white wood, spruce or oak lumber, as desired, the grade of the material determining the cost. All tanks are warranted water-tight, and the manufacturers claim that neither paint, putty nor calking are required to make them so. The manufacturers erect these tanks under a guarantee which they claim fully protects their customers in every respect.

CORCORAN RECTANGULAR TANK FOR CHEMICAL SOLUTIONS.

Associations and Societies

DIRECTORY OF AND REPORTS OF THE PROCEEDINGS OF THE METAL TRADES ORGANIZATIONS.

THE FOUNDRY AND MANUFACTURERS' SUPPLY ASSOCIATION.

President, Geo. R. Raynor, Niagara Falls, N. Y.; Secretary, C. E. Hoyt, Lewis Institute, Chicago, Ill.; Treasurer, J. S. McCormick, J. S. McCormick Co., Pittsburg, Pa. All correspondence should be addressed to the Secretary, C. E. Hoyt, Lewis Institute, Chicago, Ill. The objects of the Association are for the commercial and technical education of iron and metal industries by co-operating with all foundry and manufacturing interests in making an annual exhibit of supplies and equipments in conjunction with the meeting of the American Foundrymen's Association. The next exhibit and convention will be held in Pittsburgh, Pa., May 23-26, 1911.

At a recent meeting of the executive committee of the Foundry and Manufacturers' Supply Association a dividend amounting to 40 per cent. was authorized to be paid to the Detroit exhibitors.

The committee appointed by President Raynor, consisting of S. T. Johnson, F. B. Stevens and F. N. Perkins, to investigate the question of incorporating the association, reported that: Since the convention in Detroit the molding machine manufacturers and others (representing over one-third of space at exhibit held at fair grounds), have incorporated under the laws of the State of Pennsylvania as the Foundry and Machine Exhibition Company, capital $25,000, and after investigation they find the purposes and intentions of this corporation are identical with objects of organization which the Foundry and Manufacturers' Supply Association proposed. The committee finally recommended that the members of the Foundry and Manufacturers' Supply Association join the new corporation.

NATIONAL ASSOCIATION OF BRASS MANUFACTURERS.

President, Theo. Ahrens, Louisville, Ky.; Commissioner, William M. Webster, Chicago, Ill. All correspondence should be addressed to the Commissioner, William M. Webster, 1112 Schiller Theater Building, Chicago, Ill. The objects of the Association are to promote in all lawful ways the interests of firms engaged in the manufacture of brass goods. Meets every three months. Each meeting fixes the place and date of the meeting to follow; consequently there is no stated place. It has been customary for the Association to hold its Annual Meeting in New York City in December of each year. The Semi-Annual Meeting is generally held at Atlantic City or some other sea coast town. The next meeting will be the annual one and will be held in New York City December 14, 1910.

Commissioner Webster reports that the association held a very successful meeting at the Hotel Pfister in Milwaukee on Wednesday, Sept. 14, at which time a number of new members were taken in; the question of the adjustment and equalization of freight rates came up for consideration, and a committee was appointed to investigate and report results of the best methods of modern foundry equipment and the most satisfactory way of melting metals. The matter of costs was extensively gone into and a committee appointed to take this question up in detail.

There was a committee appointed for the standardization of sizes, threads and openings in lavatories, and the several committees are to report at the next meeting, which will be the annual meeting and will be held in New York City December 14, 1910.

AMERICAN BRASS FOUNDRYMEN'S ASSOCIATION.

President, W. K. B. Patch, Toronto, Canada; Secretary and Treasurer, W. M. Corse. All correspondence should be addressed to the Secretary, W. M. Corse, 1155 Sycamore street, Buffalo, N. Y. The objects of the Association are for the educational welfare of the metal industry. Annual convention with the American Foundrymen's Association in a succession of cities, as invited. The next convention will be held in Pittsburgh, Pa., May 23-26, 1911.

Secretary Corse reports the following new members elected: A. L. Jones, Buffalo Copper and Brass Rolling Mill, Buffalo, N. Y.; Henry Souther, 440 Capitol avenue, Hartford, Conn.; F. O. Clements, National Cash Register Company, Dayton, Ohio; C. Cowles & Company, New Haven, Conn.; Morrison Brothers, Dubuque, Iowa; Berkshire Manufacturing Company, Whitney Building, Cleveland, Ohio.

Mr. Charles H. Marsland has changed his address from 414 West Embargo street, Rome, N. Y., to 179 West Dominick street, Rome, N. Y.

The following errors in list of members were made in the bulletin for July: O. M. Edwards Company, T. A. Stevens, president, London, Canada, should read The O. M. Edwards Company, Syracuse, N. Y., and Empire Manufacturing Company, T. A. Stevens, president, London, Canada; also The Fairbanks Company, Mr. George H. Benton, manager, Valve Department, should read: George H. Benton, manager, Valve Department, The Fairbanks Company, 416 Broome street, New York City.

NATIONAL ELECTROPLATERS' ASSOCIATION OF THE UNITED STATES AND CANADA.

President, Charles H. Proctor, Arlington, N. J.; Treasurer, H. H. Reama, New York, N. Y.; Corresponding and Financial Secretary, Geo. B. Hogaboom; Recording Secretary, Royal S. Clark. All correspondence should be addressed to the Corresponding Secretary, Geo. B. Hogaboom, 656 Hunterdon St., Newark, N. J. The objects of the Association are to promote the dissemination of knowledge concerning the art of electro-deposition of metals in all its branches. Meets at Grand Opera House Building, 309 W. 23d St., on the fourth Friday of each month, 8 p. m.

The twentieth regular meeting of the association was held Friday evening, Sept. 23, in the meeting room at the Grand Opera House building. Charles H. Proctor rapped for order at 8.25 p. m., with twenty-nine members present. The regular routine business was gone through with and J. H. Hansjosten was elected as an active member. The secretary reported that since the first of May, 1910, twenty members have been admitted to the association. It was ordered that the forthcoming quarterly pamphlet, issued by the association, be copyrighted.

The subject for discussion for the October meeting will be "The Electro-Chemical Cleaning Bath." Messrs. Mallard, Bernard and Baxter will read papers upon the subject.

The president read an interesting paper upon "The Production of Verde Antique" and exhibited samples of verde finishes. Messrs. Stremel and Noonan also exhibited samples of the antique green finish.

The Philadelphia branch of the N. E. P. A. held a meeting Friday evening, Sept. 30, at the offices of the Hartford Sterling Silver Company, 50 North Sixth street, at which the following officers were elected: President, Fred. C. Clement, 637 North 47th street, Philadelphia; vice-president, James Moore, 654 North 53rd street, Philadelphia; recording secretary, Joseph L. Demal, 2559 North Bouvier street; Secretary and treasurer, Albert E. Kieser, 1318 Jefferson street; corresponding and financial secretary, Fred. C. Clement; board of trustees, Hugo Herman, 2434 Clifford street; Arthur B. Wells, 50 North Sixth street; August Heck, 6122 Jackson street; John A. Wilkinson, 5103 Brown street; William J. Buckley, 2206 Pine street, Wilmington, Del. It was decided that the last Friday of each month be the meeting night, and that the fiscal year end the last of April, in regards to the payment of dues. It was also decided that they should be known as the Philadelphia branch of the N. E. P. A. The president of the new branch was instructed to write to the parent association for a charter. Including the members that are at present members of the parent association, who reside in Philadelphia, the new branch will have twenty-five members.

The following are the new members: Arthur B. Wells, 50 North Sixth street; William Joseph Buckley, 2206 Pine street; Albert Sectovin, 2911 Thompson street; William F. Buehler, 2645 North Darian street; Harry Meyer, 1415 North 20th street; Joseph F. Dinan, 2559 North Bouvier street; Albert E. Kieser, 1318 Jefferson street; Philip Uhl, 2432 North 29th street; John A. Wilkinson, 5103 Brown street; Raymond Schofield, 151 North 16th street; Walter C. Gold, 235 Race street; George C. Knecht, 4239 North 16th street; August Heck, 6122 Jackson street; Charles W. Bailes, 1025 East Berk street.

ITEMS OF INTEREST TO THE INDIVIDUAL.

T. J. McGrath has been appointed foreman plater for the English-Mersick Company, manufacturers of automobile hardware, New Haven, Conn.

Ferdinand Deming, Waterbury, Conn., the seamless copper and brass tube mill expert and master mechanic, is now negotiating with an English mill with the view of becoming its superintendent.

M. F. Legge, who formerly represented the Zucker & Levett & Loeb Company in New England, has become connected with the Apothecaries Hall Company, manufacturers of platers' supplies, Waterbury, Conn.

W. P. Eckfeldt, Jr., Reading, Pa., who formerly represented the Zucker & Levett & Loeb Company in Pennsylvania, will in the future cover the same territory for the Hanson & Van Winkle Company, of Newark, N. J.

W. W. Wells, 368 Victoria street, Toronto, Can., who has been representative for the Zucker & Levett & Loeb Company in Canada, will engage on his own account on a still larger scale than heretofore in the manufacture of buffs and other kinds of platers' and polishers' supplies.

M. W. Lawrence, formerly vice-president of the National Lead Company, has been elected president, to succeed Lucius A. Cole, who died recently at Carlsbad. Mr. Lawrence is succeeded as vice-president by A. J. Cornish, while M. D. Cole, son of the former president, has been made treasurer, to succeed E. F. Beale.

Alfred Pritchard, formerly of Brooklyn, N. Y., has taken charge of the plating department for the Hobson Manufacturing Company, of Winsted, Conn., manufacturers of jewel boxes and novelties. He reports that he has just installed a new dynamo and several large plating tanks and has enough orders on hand to keep busy for at least six months.

O. H. Eggleston, formerly of the O. H. Eggleston Company and a well-known electroplater of Providence, R. I., reports that he is nicely started in his new quarters, and entirely satisfied with the business done since he has been there. Mr. Eggleston has an entirely new outfit for coloring and electroplating, and guarantees satisfactory work at reasonable prices.

James N. Morehouse has severed his connections with the James N. Morehouse Company and the Newark Brass Name Plate & Engraving Company. Mr. Morehouse was a pioneer in the job plating business of Newark, and won an enviable name for himself in that line. He has not decided just what he will do, after a needed vacation, but has some flattering offers from large concerns.

Leonard P. Morgan, assistant smelter and refiner at the Philadelphia mint, recently appointed by the British government to take charge of the new refinery at the Ottawa branch of the new mint, is now well started on his new duties. Mr. Morgan was one of the main assistants to Dr. D. K. Tuttle, head of the refining department of the United States, and will introduce the Wohlwill

system for electrolytic refining of gold in Ottawa, and if successful it will also be installed in the mint at London.

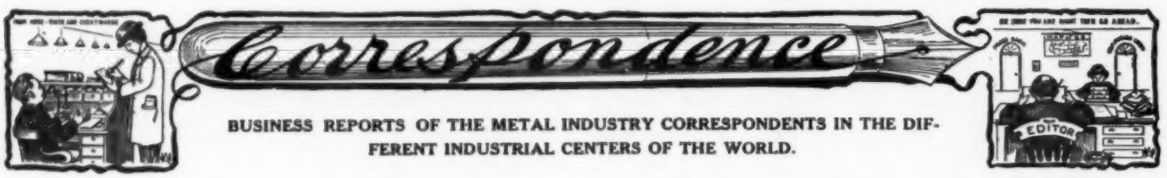
Percy S. Brown, chemist for the Western Electric Company, 463 West street, New York, has been transferred to the Western works of the company at Hawthorne, Ill. Mr. Brown, it will be remembered, was one of the organizers and secretary of the National Electroplaters Association, and no doubt he will be active in forming a Western branch of the association as soon as he is settled in his new locality. His address for the present will be care of the Western Electric Company, Hawthorne, Ill.

S. Herrick has been appointed foreman of the plating and polishing departments for the Brass Products Company of Southbridge, Conn. Mr. Herrick was the first plater to be employed by this company, and he reports good progress in the various lines of products sent out by them. This company manufactures a high grade of gas and electric and combination fixtures, and business has increased so rapidly that plans have been completed for a building which will admit of twice the capacity of the present one.

DEATHS

Frederick A. Newell, president of the firm of Watson & Newell Company, of Attleboro, Mass., silversmiths, died at his home, 438 Hope street, Providence, R. I., early on the morning of Sept. 20, after a brief illness. Mr. Newell, who was born Oct. 8, 1845, at Franklin, Mass., was a man of broad and philanthropic spirit, and had done many acts of charity in a quiet way, in addition to making large gifts of property, both for charitable and educational purposes.

In his boyhood days Mr. Newell attended school in Franklin and at the conclusion of his studies worked upon a farm. Later he found employment in the straw shops of his native town until the Civil War broke out. He enlisted as a private in Company G, Fifth Massachusetts Volunteers and went through his term of service. After working in various straw factories he became interested in the manufacturing jewelry business at Attleboro and started in a small way as Cobb, Gould & Company. In 1874 the Watson & Newell Company was formed, Mr. Newell associating himself with Clarence L. Watson. The business grew very rapidly and employs several hundred hands at present.



BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS IN THE DIFFERENT INDUSTRIAL CENTERS OF THE WORLD.

WATERBURY, CONN.

Oct. 10, 1910.

There has been a steady and general improvement all along the line in the metal industries throughout the Naugatuck, although there have been some indications of a decrease in business in one line here and there. Most of the Waterbury shops are running on full time in all departments, but there is no great rush and all could easily handle from 10 to 25 per cent. more orders without feeling the pressure too great. On the whole the general tone is healthy and the outlook reassuring.

The Randolph-Clowes Company forces went on full time about the middle of September after a schedule of forty or fifty hours a week during the month preceding, and full forces are working sixty hours a week now in the tube and brass mills.

The tube and wire mills of the Benedict & Burnham Manufacturing Company (American Brass Company) show increased activity and are on a schedule indicating a steady and increased flow of new orders. At the Waterbury Manufacturing Company's and the Chase Rolling Mill Company's plants the same conditions prevail as a rule, while the Scovill Manufacturing Company has practically all departments running on full time.

A large order came to the Scovill Company recently from the United States government for copper blanks for pennies. This was said to be a surprise as far as its size was concerned, as the government has been doing much of that work itself the past four years. Curiously enough, rumors were afloat about the time that that order was received to the effect that times were getting dull at the factory. Answering an inquiry as to that report, E. O. Goss, of the company, stated that, if anything, business was a trifle better than at the same period last year, and while help was coming and going on various departments the plant, as a whole, was enjoying prosperous conditions. One of the best signs is the continuance of business on a generous scale in all the small factories. The novelty manufacturing concerns, special machine shops and foundries and rolling mills are all doing well, prominently repudiating the croaking of speculators in other parts of the country.

From nearby cities the same reports come. New Haven financial and industrial authorities seem unanimous in the belief that all the factories there, where the products are chiefly metallic goods, are in for full time all fall and winter. The Winchester Repeating Arms Company, the New Haven Clock Company, the Sargent Company and the numerous small machine concerns are reported busy, with goodly orders. Derby, Ansonia, Winsted and Torrington concerns are all going well, although the recent change of the Coe Brass Company's schedule in Torrington to five days caused some doubtful speculation as to the outlook. This was simply a precautionary measure, it is believed, in line with what seems to be a general policy; that of avoiding any large accumulation of stock. Over against this may be set the edict of Thomaston manufacturers, the Seth Thomas Clock Company and the Plume & Atwood Manufacturing Company, to cut out the Saturday half holiday and work six full days. These two concerns make watches of medium and high grades, house and tower clocks, and brass and copper hardware of all kinds.

In Waterbury's clock and watch shops all hands are busy and the last of holiday orders are now being rushed out for the retail markets, while the men on the road are sending in fresh orders of reassuring volume. It is nothing remarkable, perhaps, this business, but in the face of the general tendency to await political developments in all parts of the country it is a good sign.

One of the best indices to industrial communities like the Naugatuck valley and other brass and metal producing centers is the building record of the past year. With such a general increase in building a large amount of metal products is undoubtedly being used up and the outstanding quantities rapidly reduced. As there is slight indication of a halt in this direction for some time to come, the factories hereabouts are renewing orders in larger quantities for such small products as builders require. The advances in the direction of fireproof construction and the increase in consumption of brass hardware and wire of all kinds help metal producers greatly.

Another recent advance favoring brass makers is due to the increased cost of paper boxes and wrappings, causing an increase in the demand for the more substantial tin and brass boxes and cans of every shape and description. Waterbury turns out millions of these or their parts every week for powder, soap, hardware and other concerns.

These are arguments, perhaps, for optimism, but they are

here in material form and speak for themselves in the dead sure figures of freight and express shipments, which certainly show no decline hereabouts large enough to cause any worry.

Collections are slightly improved. F. F. B.

PROVIDENCE, R. I.

Oct. 10, 1910.

The manufacturing jewelry establishments of Providence and the Attleboros have entered upon the season of holiday business with good orders on their books for all kinds of goods, from the most costly to those of moderate price. In consequence about all departments are operating on full schedule in a majority of shops, and a few factories are running operating overtime. Perhaps the best feature of the early fall trade, from the manufacturers' standpoint, is that collections are better than for some time past. The activity is not confined to any one line of goods. Among the phases of the trade, however, is the mesh-bag business, in which the reports from the West remind one of the late Mulberry Sellers' report on the need of water. "Think of China! Millions of people! And all have sore eyes!" The application lies in the fact that great as is the activity in the mesh-bag business, the market has only recently extended to the West, and has lots of room to grow.

The Rhode Island Branch of the National Metal Trades Association, which comprises employers connected with a number of the manufacturing establishments of this vicinity, held its summer outing at the Warwick Club grounds recently. There were no formalties, the affair being simply in the nature of a general good time, and those present to the number of about 65 made the most of the opportunity to break loose. The party went to the grounds by special electric car and upon arrival, after a lunch, had games of varied kinds and a shore dinner. All reported having had an exceptionally good afternoon's outing.

A creditors' petition was recently filed in the United States Court for the District of Rhode Island asking that Frank W. Grant of this city, doing business as Frank W. Grant & Co., electroplaters, 35 Garnet street, be declared bankrupt. The petitioning creditors were Knute B. Pfeiffer, of Stouton, Mass., with a claim of $750; Clara A. Briggs, of this city, with a claim of $100, and H. Clinton Crocker, of this city, with a claim of $825. All of these claims are for money alleged to have been loaned. The creditors in their petition claim that Grant has committed an act of bankruptcy and has admitted his inability to pay his debts.

The Lebanon Gold & Precious Metal Company, capitalized for $100,000, to be located in this city, was incorporated recently at the office of the Secretary of State. The concern is formed for the purpose of mining, milling and dealing in precious stones. The incorporators are Charles A. Crouch, of Lebanon, N. H.; William B. Carpenter, Albert M. Whipple, both of this city; Henry W. Kimball, of Pawtuxet, and George L. Titus, of East Greenwich.

The plant of Leary & Penfield, manufacturing jewelers, at 59 Page street, this city, has been sold by the trustee in bankruptcy to W. E. Hallam and H. W. Rice, who will continue the business as Hallam-Rice Company. Two dividends aggregating 35 per cent. have been declared and it is expected that the asset of the firm will net the creditors approximately 40 per cent. The firm was petitioned into bankruptcy some time ago with liabilities of $15,048.61 and nominal assets of $13,718.90.

Lawrence F. Crotty, trustee in bankruptcy of the Macomber Manufacturing Company, manufacturing jewelers, 109 Friendship street, this city, which was petitioned into bankruptcy in June last, has sold the entire plant to W. F. Lally, of Meriden, Conn., who will continue as the Meriden Manufacturing Company. A dividend has been declared for the creditors, payable on and after October 13.

With the A. T. Wall building on Clifford and Claverick streets completed and ground cleared and broken for the new Watts-Thresher Company building on Chestnut and Pine streets, two more large manufacturing edifices have been added to the number in this city devoted exclusively to the manufacturing jewelry industry and its allied branches. Both are fully equipped with the most modern conveniences and are worthy additions to the wealth of the city.—W. H. M.

NEWARK, N. J.

Oct. 10, 1910.

There is not much of a change in the conditions of the manufacturing jewelry trade since last month. The vacation period is over now, the factories are at work on fairly good time, many are quite busy, but the trade as a whole is not really rushed with business. However, the situation continues to improve and a good fall and winter trade is looked for. The wholesalers have their lines out, which the manufacturers attend to first, and now the latter who cater to the retail trade are covering the country with their own salesmen and report fair conditions. The East seems a little slow, the bulk of the orders coming from the South and the West. Particularly in the latter States money seems more plentiful and there is a more general buying movement.

Speaking in a general way, the retail jewelers are not stocking up much, preferring to buy stock as needed and not go into debt or put money in lines that are hard to realize on. The jewelry lines are selling very well; silver goods and novelties are quite brisk, optical goods show improvement, tools, machinery and supplies are in very good demand, metal goods and novelties are making a good showing.

One of the most disastrous fires here for some time was the burning Sept. 12 of the Shiman-Miller building at Murray and Austin streets, which was erected about a year ago and was occupied exclusively by the manufacturing jewelry, silver and optical goods lines. The loss amounts to $150,000, and the fire started in the finishing room of the Eastwood-Park Company. There were 500 employees in the building and some had narrow escapes in getting out of the building. In the rear was being built an enlargement to this building and the factory destroyed will also be rebuilt as soon as possible. There will be a large lot of new machinery, supplies and equipment needed by the following firms who will get new quarters or remain in the present building when rebuilt. Insurance will cover most of the losses.

The Shiman-Miller Company, making jewelry, have taken temporary quarters in the Reusch Building, 401 Mulberry street. They had a stock on hand valued at $100,000 and had 100 hands at work.

The Eastwood-Park Company, making silver goods, had 250 employees and had a stock on hand valued at $100,000.

The Loures Optical Company has thirty hands at work and their loss was mostly by water. Henry Ziruth, chair manufacturer, had fifty hands and was pretty well burned out. Eckfeldt & Ackley, making high-grade jewelry, had thirty hands working and did not have a big loss. The Harvey Osborne Silver Company made silver toilet articles, employed thirty hands and had considerable loss. A large stock of goods was on hand ready for shipment. The Missner Jewelry Company have started in business to make a general line of gold jewelry in the Richardson Building on Columbia street.

The Shickerling Manufacturing Company, who have been in business for years at 391 Mulberry street, but have not been doing business for a year, have been sold and the business will be carried on at 71 Nassau street, New York City, by Schickerling & Company, which is not the same firm, however.

William Smith & Company, who moved here from Providence, R. I., N. 401 Mulberry street, making chains, have also taken up the manufacture of a general line of gold jewelry. S. Messerer, a retail jeweler of Springfield avenue, is a great mechanic and he has fitted up in the rear of his store a small factory for the making of optical goods and has a nice little plant in good working order.

Nosher & Gwynn, of Clinton street, manufacturing opticians, have made an addition to their plant by putting in more machinery. Hanson & Van Winkle, manufacturers and jobbers of polishing materials and supplies, have opened an uptown branch with Albert Courter & Company, 110 Mulberry street. C. Rech & Son, 481 Washington street, making gold chains, have taken up the manufacture of pendants and La Vallieres. Theberath & Company have much better facilities, more machinery and larger quarters since moving from Franklin street to the Harpers Building.

The H. J. Reusch Machine Company, making tools and machinery for the jewelry, silver and metal working trades, moved from Green street and are in their fine large factory building erected at 401 Mulberry street. They have much better quarters, larger facilities and are quite busy. They occupy the ground floor of the building, while the upper floors have been rented to other firms and all but one in the jewelry and silverware lines.

Mills & Batt, who have for many years been with B. L. Strassburger & Company, of 31 Maiden Lane, New York City, have started in making medium grade platinum and diamond jewelry in this city at 129 Oliver street. Both members of the firm go on the road. A 10-karat line will also be made of jewelry. The Bracher Manufacturing Company, of Mechanic street, are doing a good business in oil stones, jewels, etc., and expect to cut diamonds, agates, sapphires, etc. If so a larger plant will be put in. This firm have only been in business a couple of years and have mines in Arkansas at Little Rock, where they get the oil stones.

Charles Keller & Company, 211 Mulberry street, have built an addition to their factory building which they will occupy themselves. It will give them much more space and with extra machinery will be in a position to turn out a much larger output than before of gold goods.

The firm of Goldsmith-Koch Company, 109 Oliver street, took in the membership of the firm L. Witzenhausen, of L. Witzenhausen & Company, jobbers of New York City, at 37 Maiden Lane. The firm here have enlarged the factory by taking another floor, put in new machinery and make silver mesh bags and toilet ware.

A. Griffoul & Brother, 290 Chestnut street, who do a large brass and bronze founding business, have given up the gold and silver line, but will go into another line that will interest the trade.

Charles Hahn moved his factory from 520 Eighteenth avenue to 20 Mercer street, making ten to fourteen-karat gold and platinum chains. He also expects to enlarge the factory and has also taken up the manufacture of silver and German silver mesh bags. Salesmen will be put out and a lively business is looked for.

A new firm started in not long ago when Otto Schonbacher, of Schonbacher & Broad, with John Heupel and William Biebel formed a partnership as Schonbacher & Company, 32 Marshall street, to make a general line of ten to fourteen-karat gold jewelry. They put in a new line of machinery, have a first-class and well lighted factory and a full complement of hands.

The Wheeler Jewelry Company moved their plant from 24 Boudinot street to the Schlosstein Building and put in new machinery to make a general line of ten-karat gold jewelry and combs. J. E. O. Wyngaert has joined forces with this firm. Sueedin & Turner, who succeeded Bergen & Von Der Heide, making gold filigree fountain pens at 24 Boudinot street, sell to the jobbing trade and do some fine silver deposit work. Since the fire in the building where they are, they have taken quarters on the second floor and have much better facilities than before.

The Meyer Machine & Tool Company have bought the building at 146 Lafayette street and moved to it from 288 McWhorter street. They occupy two floors, have put in more machinery, and are making now a machine to sharpen dies, which is sold to the manufacturing jeweler, silversmith or metal worker, who can sharpen his own dies. This firm are doing a large business and have much larger facilities.

The Empire Jewelry Manufacturing Company moved from 46 Oliver street to the Schlosstein Building, where they have much better facilities for the making of ten-karat gold jewelry. Charles Hahnhold, former president of the concern, is now superintendent. A. E. Bennett, of 35 Maiden Lane, attends to the New York selling end. They will sell to the retail trade. A new firm to make vegetable ivory buttons is the Newark Vegetable Ivory Button Company, Arlington street. The W. C. Edge Jewelry Company, of 46 Green street, have moved to much larger and better quarters in the Herpers Building, at Washington and Crawford streets. They have 4,200 square feet of space and make gold mesh chains, bracelets, etc., the only firm here making this mesh line. They have also taken up the making of pendants and La Vallieres. H. S.

CLEVELAND, OHIO.

Oct. 10, 1910.

Business conditions with those engaged in the metal industry continue excellent in this territory, according to the reports of the leading manufacturers here. Renewed confidence in the future of Cleveland as a manufacturing center came during the past month when the census bureau announced Cleveland's population. The city now has 560,663 persons within its borders, an increase of over 168,000 in ten years, or 46 per cent. Cleveland by this new showing passes Pittsburg by 27,000 and forges ahead of its old time rival, Baltimore, by over 2,000, making it the sixth city of the United States in point of population. Cleveland shows the largest percentage of gain of all the big cities of the country, except one. For twenty years its growth has been steady, for ten years ago the increase shown was 46.1 per cent., while this year it is 46.9. Big manufacturers here are exceedingly gratified at the city's showing, especially as it has passed Pittsburg by a big margin. Cleveland is now 195,000 larger than Cincinnati, which twenty years ago was its closest rival. It is hoped that in another ten years Cleveland will outstrip both Boston and St. Louis, so rapidly is it growing. This growth, too, is dependent largely upon its metal industries, for Cleveland in addition to being very largely interested in the iron and steel business has large brass and aluminum manufacturing plants which rival the largest in the country.

The automobile makers here report a better tone to the market than a month or two ago. Business outlooks indicate that the slump due to the approach of winter is not as extensive as it was believed it would be. New models are being gotten out and there is a fair demand. Some of the makers have laid off some of their workmen, but the factories for the most part are confining themselves to turning out stock for next season. Business with the plumbing fixture makers is quite active and huge quantities of stock are being furnished the retail and jobbing trade. The aluminum foundries are also doing a good business, the demand for aluminum castings for new fangled air craft being steadily on the increase. Glenn Curtiss and several other important aviators get all their castings for their aeroplanes in this city.

A number of factories which are extensively interested in brass and copper castings are indicating their prosperity by making new additions to their plants. The Chandler & Price Company, largest makers of printing presses in the world, are building a $60,000 factory, to be used for foundry and power producing purposes. The Ferro Machine & Foundry Company, largest makers of marine engines in the world, are building a two-story addition, 55 x 120 feet in size. The American Can Company, making all kinds of metal cans, are adding a five-story extension, 40 x 150 feet in size. The Warner & Swasey Company, manufacturers of optical instruments, are building a six-story addition. The White Sewing Machine Company this month moves into its fine new factory covering about six acres on St. Clair avenue, adjoining the plant of the White Automobile Company. The Reliance Electric & Engraving Company has started work on a $30,000 factory.

One of the interesting incorporations of the past month was that of the Cuyahoga Manufacturing Company, Cleveland, to engage in the manufacture of airships and automobiles. Wm. F. Bonnell, J. E. Rawson and others incorporated the concern for $10,000.

An interesting case was settled during the month when the Dueber Watch Case Company, of Canton, O., lost its long fight to keep the Keystone Watch Company from doing business in Ohio. Attorney General Denman has instructed Secretary of State Thompson to receive and file the papers of the Keystone Company, known as the watch case trust. This permits the Pennsylvania corporation to invade the Ohio field as a foreign corporation. Efforts are now to be made to attack the Keystone Company on the ground that it is an illegal corporation. Smaller watch case concerns claim the larger one is trying to drive them out of business. S. L. M.

TRADE NEWS

TRADE NEWS OF INTEREST DESIRED FROM ALL OF OUR READERS. ADDRESS THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK

Additional Trade News will be found under "Correspondence."

The Globe Machine & Stamping Company, Cleveland, Ohio, are preparing for the construction of a manufacturing plant comprising several buildings.

The Fulton Company, of Knoxville, Tenn., have erected a new building, which is being used as a brass foundry for the production of castings for steam specialties.

The Ohio Brass Company, Mansfield, Ohio, is marketing a metal for use in the bearings of engines, generators, motors, etc. This metal is claimed to be made after Isaac Babbitt's original formula.

The Smith Electric Company, Charlotte, N. C., are in the market for buffs, wire and Tampico brush wheels and finishing composition for all of the various brass finishes. They will also want a small steam or hot water generator to be operated by gas.

The firm name of the Ben F. Slack Brass Manufacturing Company, 1638 Blake street, Denver, Colo., has been changed to the Slack-Horner Brass Manufacturing Company. They claim to be the largest brass and bronze manufacturing company in the West and also operate a plating department.

The Vanderbilt Cup race, which was run on Long Island, N. Y., on Oct. 1, was won by an "Alco" automobile manufactured by the American Locomotive Company. A car of the same make won the Vanderbilt Cup in 1909. The motors of both cars were equipped with Cramp's Parsons white brass bearings.

The Reama Silver Plating Company of Springfield, Ohio, has been purchased by J. A. and W. H. Clifton and the business will be conducted under the name of the Clifton Silver Plating Company. The new concern has started operations that they report that the outlook is favorable for future orders.

The Aluminum Castings Company, with head office at Cleveland, O., and branches at various points throughout the country, announce that they are making patterns in wood and brass for the trade. They have an absolutely fireproof building, modern equipment and a force of thoroughly experienced pattern makers.

The Rockwell Furnace Company, 26 Cortlandt street, New York, announce that in order to facilitate their rapidly increasing business in the Middle West they have opened a branch office in the Fisher Building, Chicago, Ill., in charge of A. L. Stevens, an experienced furnace engineer who has been conected with the Rockwell Furnace Company for some time. Inquiries addressed to the Chicago office will receive careful attention.

The Connecticut Dynamo & Motor Company, New York, manufacturers of dynamos and electric equipment for platers and galvanizers, whose products have heretofore been sold by the Zucker & Levett & Loeb Company, of New York, announce that hereafter they will sell direct to the trade themselves. Present users of their machinery who may require repair parts, etc., as well as new customers will be taken care of by the company, whose office is at 524 West 25th street, New York.

The "Nonesuch" plating barrel, which has recently been put on the market by Rockhill & Vietor, 114 John street, New York, and which was described in the September number of THE METAL INDUSTRY, has been still further improved by a new design for the barrel, which permits the use of canvas panels, in place of celluloid or wood, on all sides of the barrel. This, according to the inventor, permits the electric current to pass through the walls of the barrel much more freely than where wood or celluloid is used.

The J. D. Smith Foundry Supply Company, Cleveland, Ohio, announce that they have appointed the Barnes-Edwards Company, 1001 Arrott Building, Pittsburg, Pa., as their agent for that territory, and John H. Morrison, 88 Harbord street, Toronto, Canada, to handle that trade. They also announce that they have purchased the patents of the Bayer Pattern Plate & Manufacturing Company, of Cleveland, and hereafter will manufacture the well-known Match Plate Composition, and also the Combination Roll Over and Squeezer Molding Machines, formerly made by the Bayer Company.

The Bronze Metal Company of Erie, N. Y., with an office at 30 Church street, New York City, report that their new factory buildings at Erie are now occupied with a force of fifty-five men, and as soon as the new furnace room, now under course of construction, is completed they expect to make room for a few more. The Erie plant is only one of a number of plants owned by this company in various parts of the country. The plant at Erie furnishes all the various castings used by the Erie railroad. When the new furnace is in operation the company will be able to furnish castings for other railroads.

The Glacier Metal Company, manufacturers of Glacier anti-friction metal, Richmond, Va., announce that they are placing on the market a new ribbonized plastic metallic packing for steam, air, water, gas, ammonia, etc. This packing is manufactured from the finest alloy of white metal, which can satisfactorily be made into fine shreds or ribbons, is very pliable, will not score the rods, shows no corrosion when it comes in contact with acids and cannot rot, as many packings do which are made from fiber. No sizes are required to be carried in stock, as a rope can easily be made with the hands of the size required for packing the rods. No packing is more easily applied or will show longer life.

The Niagara Alkali Company, Niagara Falls, N. Y., are making a specialty of electrolytic caustic potash, for which they are the sole American manufacturers. They furnish this in liquid form containing from 45 to 49 per cent. potash in any size drums, and in solid or broken form containing 90 per cent. potash. They also manufacture muriatic acid of from 18 to 22 degrees strength, free from sulphur and arsenic. The officers of the company are H. D. Ruhm, president and general manager; E. M. Sergeant, vice-president and assistant general manager; F. O. Geyler, secretary and treasurer, and Levi Shewan, superintendent, The National Aniline & Chemical Company, 100 William street, New York, are sales agents. Considerable quantities of their goods are also handled by the Charles E. Sholes Company, New York, and C. H. Talcott & Company, Hartford, Conn.

NEW ELECTROPLATERS' SUPPLY FIRM.

Announcement will shortly be made to the trade giving particulars of the organization of the Backus & Leeser Company, with offices and factory at 410 and 412 West Thirteenth street, New York. The firm is composed of C. G. Backus, who was for a number of years connected with the Zucker & Levett & Loeb Company as their factory superintendent, and C. W. Leeser, formerly credit manager of the same company. The new concern will represent The Harshaw, Fuller & Goodwin Company, of New York, Cleveland, O., and Elyria, O., the well known

manufacturers of chemicals and platers' supplies. A stock of their specialties will be carried in New York, including such lines as cyanide of potassium, nickel anodes, nickel salts, carbonate of copper, and carbonate of zinc. These goods are well known to the plating trade and The Harshaw, Fuller & Goodwin Company intend to complete their line of platers' supplies so that they will be in a position to furnish anything any plater may want. The territory covered by the Backus & Leeser Company will include New York City, Pennsylvania, Maryland and New Jersey. They will also represent other manufacturers, including the Keystone Emery Mills of Philadelphia, Pa., importers and manufacturers of Turkish emery.

Mr. Backus has been interested in the plating trade from boyhood up. He acquired a knowledge of chemistry during his school days and his vacations were spent in getting practical experience in various plating shops. After leaving school he became regularly connected with a large firm and before long was occupying a position as foreman. He has been in charge of plating rooms employing as many as 150 men at one time. A few years ago he became identified with the selling end of the platers' supply business and later was engaged by the Zucker & Levett & Loeb Company as their factory superintendent. He is the inventor of several improvements in plating equipment for which patents were issued to him. Of late years he had charge of the estimating for that concern and also spent a considerable part of his time in assisting any of the firm's customers who were having difficulty with their work. Thus equipped with many years of practical experience Mr. Backus will probably have little difficulty in making his services valuable to the customers of the new firm which he has organized. The active connection of his partner, Mr. Leeser, with the platers' supply trade for a long period will also be of value to this new concern.

EQUIPMENT WANTED.

We are advised by J. Fillmore Cox, M. E., president and general manager of the Smith & Cox Company, Bayonne, N. J., that this company will require for their new plant a large quantity of equipment of various kinds.

The Smith & Cox Company will manufacture all kinds of pipe and tube bends, and coils of every kind, and will also manufacture for others any standard article or do any kind of mechanical work which their facilities will permit them to undertake. They are open for bids and will be glad to receive catalogues and quotations on any of the following material:

A power plant, either steam, electricity or gas, as may be decided upon; electric lighting plant for factory and office, including arc and gas arc lights; radiators for heating factory and office; hangers, shafting, pulleys, belts; variable speed and constant speed motors; iron bench legs, electric welding machinery, oxide welding apparatus; pipe threading and cutting machinery, all kinds of bending machinery, forges; furnaces, oil, gas and coke; hand forges, anvils, steam hammers, forging machinery, furniture and equipment for draughting room and office, engine lathes, milling and boring machines, drill presses, shapers, etc.; cranes, conveyors, hoists, tracks and cars; wrenches, cutters, and all small tools used on pipe work. Especial attention is called to the fact that they will be extensive users of pipe, tubing and all kinds of fittings used in connection with high pressure work and steam purposes, ammonia fittings, etc. The company will be pleased to receive any data or matter bearing on this subject as to sizes, threads, pressures, etc., etc. As they will establish a catalogue library, they will be pleased also to receive catalogues, data, etc., pertaining to mechanical, electrical, steam and allied lines. J. Fillmore Cox, M. E. 26th street and Boulevard, Bayonne, N. J., will furnish any additional information desired. The new plant is to be located at the foot of 37th street and Avenue E, Bayonne, N. J.

RECEIVER'S SALE OF THE ZUCKER & LEVETT & LOEB COMPANY.

In our September issue we announced that a receiver had been appoinetd for the Zucker & Levett & Loeb Company, the well-known manufacturers of electroplaters' supplies, at 524 West 25th street, New York. On Oct. 3 bids for the sale of the property, good-will, etc., were received by the receiver, A. H. Skillen. Offers were invited for all or any part of the company's property. A number of bids for small quantities of stock, machinery, etc., were opened and one bid for the complete plant, including machinery, stock, fixtures, patents, formulas, good-will, orders on hand, etc., in fact everything except the company's accounts, was received from The Levett Manufacturing Company, of New York. This bid, which amounted to over $16,000, was, on the advice of the creditors' committee, accepted by the receiver and arrangements were made for turning over the business to the Levett Manufacturing Company.

This marks the passing of one of the oldest electroplating supply houses in the country. The business was originally established in 1863, by Alexander Levett, under the title Zucker & Levett. In 1881 the name was changed to Zucker & Levett Chemical Company and the firm was reorganized. In 1894 the company was consolidated with Loeb & Company and the name changed to Zucker & Levett & Loeb Company. Alexander Levett was president of the successive companies until 1894, when he was succeeded by Charles Loeb, who continued in that office until his death in March, 1910. The vacancy created by Mr. Loeb's death was filled by the election of Donald McDermid, who had previously been treasurer.

A few years ago a disastrous fire occurred in the plant on West 25th street, and as a result it is said the company suffered a loss of $50,000 or $60,000, which handicapped them considerably in carrying on the business. Recently the conditions grew so serious that the company called a meeting of its creditors at which a committee was appointed which examined its affairs and reported liabilities of about $120,000 and nominal assets of about $200,000, the actual value of which was estimated at from $30,000 to $40,000 in stock, machinery and accounts. The recent sale of the property to The Levett Manufacturing Company included, as stated above, everything except the accounts.

The Levett Manufacturing Company, which now comes into possession of the old business of the Zucker & Levett & Loeb Company, was organized in February, 1909. George W. Levett, son of Alexander Levett, is president; Charles M. Levett, vice-president, and Frank M. Levett, treasurer. In addition to securing the property of the old company, the Levett Manufacturing Company has engaged a number of the employees of the old company, including several of the factory department heads and some of the salesmen. P. H. Bergin, who was the inventor of the well-known Triplex buff and who represented the Zucker & Levett & Loeb Company in New York State, will cover the same territory for The Levett Manufacturing Company; E. Lamoureux will be their Western representative. C. G. Backus, who was for some time general superintendent, and C. W. Leeser, who was credit manager, will engage in business in New York City on their own account. The announcement of their plans will be found elsewhere in this issue.

REMOVALS

The Cockerill Zinc Company, miners and manufacturers of zinc, formerly located at Nevada, Mo., have moved to Bridgeport, Ala.

The Ohio Sherardizing Company, formerly located at 307 Garfield Building, Cleveland, Ohio, have moved to the Whitney Power Building.

The Manufacturing Company, manufacturers of metal goods, formerly located at 496 East 134th street, New York City, have moved to 162-72 Southern Boulevard.

The Hawley Down Draft Furnace Company have moved their office to their new factory at 736 and 738 West Monroe street, Chicago, Ill.

The Star Brass Works Company, formerly located at 2106 Campbell street, Kansas City, Mo., have moved to 1721 Baltimore avenue, where they have larger quarters.

The Potters Kiln and Tool Works, formerly located at 3147 Cottage Grove avenue, Chicago, Ill., have moved to 1750 Sheffield avenue. The Potters Works are manufacturers of the "Kuehl Natural Draft Oil Burning Melting Furnaces," which are particularly suitable for melting the non-ferrous metals.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Correspondence" columns.

NATIONAL METAL COATING LITHO COMPANY, 129 Franklin street, Elizabeth, N. J. Capital, $4,000. To engage in the painting, varnishing and enameling and the coating of metals. Incorporators: W. H. Lambert, Daniel McIver, Elwood W. Phares and Clark McK. Whiltemore, all of Elizabeth, N. J.

IMCO MANUFACTURING COMPANY, New York City. Capital, $5,000. To manufacture and deal in lead, copper, brass and plumbers' supplies. Incorporators: Michael J. McCloud, 162 East Fifty-second street; I. E. Ikelheimer, 32 West Eighteenth street; Emanuel Ikelheimer, 117 East Fifty-sixth street, all of New York City.

INCREASE OF CAPITAL STOCK

The Hancock Manufacturing Company, Charlotte, Mich., manufacturers of brass goods, have increased their capital stock from $30,000 to $100,000. This is for the purpose of making extensive improvements, details of which have not been completed.

The capital stock of the Metal Products Company of Detroit, Mich., has been increased from $200,000 to $300,000, and was entirely taken by the original stockholders. The increase was made to provide extra working capital and for the installation of new machinery.

The McRae & Roberts Company, Detroit, Mich., manufacturers of brass goods for steam, water and gas, have increased their capital from $125,000 to $400,000. They are also extending their plant by erecting a three-story building, 60 x 320 feet, which they expect to occupy by Dec. 1, and which will give employment to from 300 to 400 new men.

PRINTED MATTER

METAL SPINNING LATHES.—F. A. Schulz, Chicago, Ill., has issued a catalogue giving illustrations and descriptions of the metal spinners' tools and chucks manufactured by him. He is prepared to manufacture any tool used in the metal spinning line, and will be glad to correspond and furnish estimates for furnishing any machinery of this description.

ASSAYS AND CHEMISTS SUPPLIES.—The Denver Fire Clay Company have issued their 1910 illustrated catalogue of assays and chemists' suppplies, scientific apparatus. The book contains 420 pages and gives full description and prices of crucibles, muffles, scarifiers, furnaces, chemical and physical apparatus, general laboratory supplies, etc. W. W. Case, Jr., is the president and manager, and John Donaldson, secretary and treasurer of this company.

ANTI-FRICTION METAL.—The Ledell-Bigelow Company, 18 Broadway, New York, have issued a series of small catalogues giving descriptions and directions for the use of their various forms of anti-friction bearing metals. These metals are known under the trade mark name of "Bee," and include "Sampson," "Crosshead" Brittania, casting and printer's metals, white brass, bar solder, lead, antimony, copper, etc., and also alloys to specifications. These catalogues can be obtained upon request.

POLISHING AND BUFFING MACHINERY.—The Bennett-O'Connell-Stevens Company, Chicago, Ill., dealers and manufacturers in polishing room machinery and equipment, have issued Bulletin 102, which contain descriptions of their various forms of polishing and buffing room machinery. The catalogue devotes ten pages to illustrations and descriptions of their new line of polishing and buffing lathes. These lathes are manufactured in a large number of varieties and designs, and full information regarding them can be obtained by applying for Bulletin 102.

AD NEWS

A. J. Corcoran, Inc., 1 John street, New York, commence in this issue to advertise their wood tanks for the use of platers and galvanizers.

The Osborn Manufacturing Company, 5407 East Hamilton avenue, Cleveland, Ohio, devote a page to the Osborn Plain Jolt Ramming Machine.

The Eureka Pneumatic Spray Company, 276 Spring street, New York, are issuing a warning against the use of all sprays which infringe on their patents.

The Paasche Air Brush Company, Chicago, Ill., invite the attention of metal finishers to their spraying apparatus, which they state is used by many prominent concerns.

The Bennett-O'Connell-Stevens Company, 15-17 S. Clinton street, Chicago, Ill., feature a number of their latest polishing machines, full particulars of which are given in their new "Bulletin 102."

The American Wire Brush Company, 277 Greenwich street, New York, advertise the "Mez" patent steel wire wheel brush, which is made in sections and may be built up to any thickness desired.

Rockhill & Vietor Company, 114 John street, New York, begin in this issue to advertise the new "Nonesuch" plating machine, which is the invention of S. C. Catlin, a practcal plater of thirty-five years' experience.

The Levett Manufacturing Company, 407 Canal street, New York, announce the purchase of the property, good will, patents, formulas, etc., of the Zucker & Levett & Loeb Company, which rceently went into bankruptcy. Further particulars regarding this matter are printed elsewhere in this issue.

The description of the Klauder-Weldon Dyeing Machine Company's tumbling barrel which appeared in our last issue created so much interest that the manufacturers have decided to advertise it regularly. A cut showing the construction of the barrel will be found on another page. The address of the Klauder-Weldon Dyeing Machine Company is Amsterdam, N. Y.

William Cramp & Sons' Ship & Engine Building Company, Philadelphia, Pa., have a page advertisement in this issue in which the fact is emphasized that Cramp's metals are used in all kinds of high-class machinery and conveyances, and that the holders of the world's records for speed on land and sea, as well as in the air, are almost invariably equipped with Cramp's metals.

Lewis Thompson & Co., Inc., importers and manufacturers of mahogany pattern lumber, 18th and Indiana avenue, Philadelphia, Pa., publish this month two full-page engravings showing their immense stocks of mahogany logs and lumber at their Astoria, Long Island, yards, and give the names of a number of the most prominent manufacturers in the country who are regular users of Thompson mahogany pattern lumber.

The Cupror Company, with offices at 50 Church street, New York, who manufacture Cupror, the metal which was recently described in THE METAL INDUSTRY, have installed an "M. V. R." melting furnace in their foundry. They state they have been very successful in securing orders for the new metal, manufacturers in a number of different trades having tried it out and adopted it in their manufactures. Their advertisement in this issue gives further particulars.

COPPER PRODUCTION

(Issued by the Copper Producers' Association.)

	October 10, 1910. Pounds.
Stocks of marketable copper of all kinds on hand at all points in the United States, Sept. 1, 1910.....	168,881,245
Production of marketable copper in the United States from all domestic and foreign sources during September, 1910.....	119,519,983
	288,401,228
Deliveries:	
For domestic consumption 64,501,018	
For export 75,106,496	
	139,607,514
Stocks of marketable copper of all kinds on hand at all points in the United States, Oct. 1, 1910....	148,793,714
Stocks decreased during the month of September..	20,087,531

METAL MARKET REVIEW

New York, Oct. 10, 1910.

COPPER.—The standard market in London was held every steady all the month, with very slight fluctuations. Spot opened at £55 12s. 6d., declined to £54 13s. 9d. and closed at £55 5s. Trading has been very dull.

The prices of copper in the New York market have held remarkably steady; there has been a fair business done with home consumers and a good demand from abroad. The tendency of the leading sellers has been to make sales and hold the price steady instead of pegging it up on each buying movement, as has been the fashion lately. Consumers have had more confidence in the market and have undoubtedly replaced considerable of the stocks that they usually carry.

Statistically the market is in good shape; the American stocks decreased during the month of August 1,759,433 pounds and the European visible supply decreased about 3,000,000 pounds during the last half of September. The foreign visible supply today is 94,320 tons, against 109,020 tons January 1, 1910. The foreign consumption has been good and there is every reason to expect a continued good foreign demand for our copper. The exports for the month were 31,733 tons.

The prices ruling today are Lake, 13c.; electrolytic, 12¾, and casting brands, 12⅝. Market closes firmer.

TIN.—The London tin market has been aggressively active owing to the manipulations of a strong bull syndicate. Spot tin in London opened at £161 10s.; prices were run up to £166 10s., the highest, gradually declining to £156 10s. and closing at £156 15s. The trading has not been very active; the spot stock has been pretty well under control of the syndicate and American buyers have had to pay the price, as usual.

In the New York market the tendency has been to get along with as little Straits tin as possible, and consumers generally have been trying the lower grades of tin in place of Straits. The consumption as estimated by the secretary of the New York Metal Exchange was 3,300 tons for the month of September. The total for the nine months shows an increase of 4,400 tons over the same period last year. The total visible supply increased about 1,000 tons during the month.

Prices today: Spot, 5 or 10 ton lots, 37 cents; October, November delivery, 35½ to 36. Market strong.

LEAD.—There has been very little change in the foreign lead prices, opening at £12 10s. and closing at £12 13s. 9d.

In the New York market prices have held very steady at around 4.45 to 4.47½, New York delivery carload lots, while the Trust price has been kept at 4.40, New York 50-ton lots. In St. Louis prices have sagged from 4.32½, 4.35 to 4.25 at the close and the market is dull and easier.

SPELTER.—The foreign spelter market has been rather firm and price has advanced 15s. per ton, closing at £23 10s., against £22 15s. a month ago.

The New York market has been more active and prices have been advanced nearly ¼ cent per pound, from 5.45 to 5.65 at the close, New York delivery carload lots. In St. Louis prices were advanced from 5¾ to 5.45 and closing at a shade lower.

ALUMINUM.—The market has been very dull and prices are unchanged. Foreign, 98 to 99 per cent. ingots, from 22 to 22½ cents for round lots, small lots from 23 to 24 cents.

ANTIMONY.—In London price of Halletts is £29, against £29 10s. a month ago. Prices in New York show very little change, Cooksons 8⅛, Halletts 7.80, Chinese 7⅜ and Hungarian grade at 7⅛ cents.

SILVER.—In London the price of silver has advanced ½d. per ounce from 24⅜ to 24⅞d. at the close. In New York prices have advanced from 52⅞ to 54 cents at the close.

QUICKSILVER.—There has been no change in the price of quicksilver. Wholesale lots, $46 per flask to $47 and $47.50 for jobbing lots.

PLATINUM.—The market is firmer and prices have advanced from $36 for hard (10 per cent.) to $40.00, and for ordinary from $34 to $37.00.

SHEETS.—There has been no change in sheet copper or copper wire, the base price being 18 cents and 14 cents, respectively; sheet brass 14 cents base. Seamless copper tubing has been reduced from 22 to 21 cents base; seamless brass tubing unchanged at 18 cents base.

OLD METALS.—There has been a better demand and more confidence in the present market prices. Consumers have been buying and stocks in dealers' hands have been considerably decreased. Prices are about the same as a month ago.

BRASS IN WIRE RODS AND SHEETS.—As against schedule prices on mill shipments we hear that such prices are being freely cut on sheets and wire by independent mills, some naming on these classes reductions of ¼c to ½c and on brazed tubing ¾c to ⅞c, dependent on specifications and quantities, making sheets and wire 12½c to 12¾c and tubes 17½c to 18c. This condition is traceable, in all probability, to slackened demand and is as prevalent in the Middle West as in the East.—J. J. A.

SEPTEMBER MOVEMENTS IN METALS

	Highest.	Lowest.	Average.
COPPER.			
Lake	12.85	12.65	12.75
Electrolytic	12.60	12.45	12.50
Casting	12.55	12.40	12.45
TIN	36.25	34.10	35.25
LEAD	4.45	4.45	4.45
SPELTER	5.65	5.25	5.60
ANTIMONY (Hallett's)	8.25	8.15	8.20
SILVER	.54	.52¾	53.29

WATERBURY AVERAGE

The average price of lake copper per pound as determined monthly at Waterbury, Conn.

1909.—Average for year, 13.416. 1910, Jan. 13⅞. Feb. 13⅞. March 13¾. April 13¼. May 13. June 12¾. July 12¾. Aug. 12¾. Sept. 12¾.

DAILY METAL PRICES

We have made arrangements with the New York Metal Exchange by which we can furnish our readers with the Official Daily Metal Market Report of the Exchange and a year's subscription to THE METAL INDUSTRY for the sum of $10. The price of the report alone is $10. Sample copies furnished for the asking. We can furnish daily telegraphic reports of metal prices. Address THE METAL INDUSTRY, 99 John street, New York.

INFORMATION BUREAU

Any firm intending to buy metals machinery or supplies and desiring the names of the various manufacturers and sellers of these products can obtain the desired information by writing to THE METAL INDUSTRY. Commercial questions are answered by return mail. Our information Bureau is for the purpose of answering questions of all kinds. Address THE METAL INDUSTRY, 99 John street, New York.

Metal Prices, October 10, 1910

NEW METALS.

	Price per lb. Cents.
COPPER—PIG, BAR AND INGOT AND OLD COPPER.	
Duty Free, Manufactured 2½c. per lb.	
Lake, carload lots	13.00
Electrolytic, carload dots	12.75
Casting, carload lots	12.62
TIN—Duty Free.	
Straits of Malacca, carload lots	37.00
LEAD—Duty Pigs, Bars and Old, 2½c. per lb.; pipe and sheets, 2⅜c. per lb.	
Pig lead, carload lots	4.45
SPELTER—Duty 1⅜c. per lb. Sheets, 1⅝c. per lb.	
Western carload lots	5.50
ALUMINUM—Duty Crude, 7c. per lb. Plates, sheets, bars and rods, 11c. per lb.	
Small lots	28.00
100 lbs. lots	25.00
Ton lots	22.50
ANTIMONY—Duty 1½c. per lb.	
Cookson's, cask lots, nominal	8.12
Hallett's, cask lots	7.80
Other cask lots	7.12
NICKEL—Duty Ingot, 6c. per lb. Sheet, strips and wire 35% ad valorem.	
Shot, Plaquettes, Ingots, Blocks, according to quantity	.45 to .60
MANGANESE METAL—Duty 20%	.90
MAGNESIUM METAL—Duty 3 cents per pound and 25% ad valorem	$1.75
BISMUTH—Duty free	2.10
CADMIUM—Duty free	.80
	Price per oz.
GOLD—Duty free	$20.67
SILVER—Duty free	.54
PLATINUM—Duty free	$37.00 to $40.00
QUICKSILVER—Duty 7c. per lb. Price per pound	64c. to 66c.

OLD METALS.

Dealers' Buying Prices. Cents per lb.		Dealers' Selling Prices. Cents per lb.
11.00 to 11.25	Heavy Cut Copper	12.00 to 12.25
10.50 to 10.75	Copper Wire	11.50 to 11.75
9.50 to 9.75	Light Copper	10.50 to 10.75
10.00 to 10.25	Heavy Mach. Comp.	11.00 to 11.25
7.50 to 7.75	Heavy Brass	8.00 to 8.25
5.50 to 5.75	Light Brass	6.50 to 6.75
7.00 to 7.25	No. 1 Yellow Brass Turnings	7.75 to 8.00
8.25 to 9.00	No. 1 Comp. Turnings	9.25 to 9.50
3.90 to 4.00	Heavy Lead	—— to 4.25
3.75 to 3.90	Zinc Scrap	—— to 4.25
5.00 to 5.50	Scrap Aluminum, turnings	5.00 to 6.00
10.00 to 12.00	Scrap Aluminum, cast, alloyed	11.00 to 13.00
14.00 to 15.00	Scrap Aluminum, sheet (new)	16.00 to 18.00
19.50 to 20.00	No. 1 Pewter	23.00 to 24.00
25.00 to 27.00	Old Nickel	28.00 to 30.00

INGOT METALS.

	Price per lb. Cents.
Silicon Copper, 10% to 20% ....according to quantity	28 to 35
Silicon Copper, 30% guaranteed. " "	38
Phosphor Copper, 5% " "	19 to 21
Phosphor Copper 10% to 15%, guaranteed " "	28 to 30
Manganese Copper, 30% " "	30 to 35
Phosphor Tin " "	34 to 36
Brass Ingot, Yellow " "	9 to 10
Brass Ingot, Red " "	11 to 12½
Bronze Ingot " "	10 to 11
Manganese Bronze " "	17 to 19
Phosphor Bronze " "	13 to 16
Casting Aluminum Alloys " "	29 to 35

PHOSPHORUS—Duty 18c. per lb.
According to quantity ..... 30 to 35

PRICES OF SHEET COPPER.

BASE PRICE, 18 Cents per Lb. Net.

PRICES MENTIONED BELOW ARE FOR QUANTITIES OF 100 LBS. AND OVER.

SIZE OF SHEETS.		64 oz. and over 60 lb. sheet 30 x 60 and heavier.	32 oz. to 64 oz. 25 to 50 lbs. sheet 30 x 60.	24 oz. to 32 oz. 18¾ to 25 lb. sheet 30 x 60.	16 oz. to 24 oz. 12½ to 18¾ lb. sheet 30 x 60.	14 oz. and 15 oz. 11 to 12½ lb. sheet 30 x 60.	12 oz. and 13 oz. 9½ to 11 lb. sheet 30 x 60.	10 oz. and 11 oz. 7⅞ to 9½ lb. sheet 30 x 60.	8 oz. and 9 oz. 6¼ to 7⅞ lb. sheet 30 x 60.	Lighter than 8 oz.
		Cents Per Pound Over Base Price for Soft Copper.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	1	2	3	6	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	3	6	9	
	Longer than 96 inches.	"	"	"	"	2	6			
Wider than 30 ins. but not wider than 36 inches.	Not longer than 72 inches.	"	"	"	"	2	4	7	10	
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	2	6	9		
	Longer than 96 inches. Not longer than 120 inches.	"	"	"	1	3				
	Longer than 120 inches.	"	"	1	2					
Wider than 36 ins. but not wider than 48 inches.	Not longer than 72 inches.	"	"	1	2	4	7	10		
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	5	8			
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	8				
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins. but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	6	11			
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	9				
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Longer than 120 inches.	3	5	9						
Wider than 108 ins.	Not longer than 132 inches.	4	6							
	Longer than 132 inches.	5	8							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, SEGMENTS AND PATTERN SHEETS, advance over prices of Sheet Copper required to cut them from. 3 cents per pound.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot, and heavier, add ..... 1 " " "

COLD OR HARD ROLLED COPPER, lighter than 14 oz., per square foot, add ..... 2 " " "

POLISHED COPPER, 20 INCHES WIDE and under, advance over price for Cold Rolled Copper of corresponding dimensions and thickness ..... 1 " " sq. ft.

POLISHED COPPER, WIDER THAN 20 INCHES, advance over price for Cold Rolled Copper of corresponding dimensions and thickness ..... 2 " " " "

COLD ROLLED COPPER, PREPARED SUITABLE FOR POLISHING, same as Polished Copper of corresponding dimensions and thickness.

COLD ROLLED AND ANNEALED COPPER SHEETS OR CIRCLES, same price as Cold or Hard Rolled Copper of corresponding dimensions and thickness.

ROUND COPPER ROD, ⅜ inch diameter or over ..... **Base Price.**

(Rectangular, Square and Irregular Shapes, Copper Rod, Special Prices.)

	Cents per lb.
ZINC—Duty, sheet, 1¾c. per lb.	
Carload lots, standard sizes and gauges, at mill	7.50 less 5%
Casks	8.00
Open casks	8.50

Metal Prices, October 10, 1910

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect June 27, 1910, and until further notice.

To customers who purchase less than 40,000 lbs. per year and over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.13¼	$0.14¾	$0.16¾
Wire	.13¼	.15½	.17
Rod	.13¼	.15½	.18
Brazed tubing	.18⅝	—	.20½
Open seam tubing	.16⅝	—	.18½
Angles and channels, plain	.16⅝	—	.18½

50% discount from all extras as shown in American Brass Manufacturers' Price List No. 7.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

To customers who purchase less than 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.14¼	$0.15¾	$0.17¾
Wire	.14¼	.16½	.18
Rod	.14¼	.16½	.19
Brazed tubing	.19⅝	—	.21½
Open seam tubing	.17⅝	—	.19½
Angles and channels, plain	.17⅝	—	.19½

5% discount from all extras as shown in American Brass Manufacturers' Price List No. 7.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

BARE COPPER WIRE—CARLOAD LOTS.

14c. per lb. base.

SOLDERING COPPERS.

500 lbs. and over in one order	18½c. per lb. base.
100 lbs. to 300 lbs. in one order	19c. " " "
Less than 100 lbs. in one order	20½c. " " "

PRICES FOR SEAMLESS BRASS TUBING.

From 1¼ to 3½ in O. D. Nos. 4 to 13 Stubs' Gauge, 18c. per lb.
Seamless Copper Tubing, 21c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron Pipe Size	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
Price per lb.	26	25	20	19	18	18	18	18	18	18	18	19	20	22	24	25

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch	$8	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1¼ inch	22	24
1½ inch	25	27
1¾ inch	32	35
1⅞ inch	45	48
2 inch	56	60

Discount 55 and 5%.

PRICES FOR MUNTZ'S METAL AND TOBIN BRONZE.

Muntz's or Yellow Metal Sheathing (14" x 48")	14½c. net base
" " " Rectangular sheets other than Sheathing	16½c. " "
" " " Rod	14½c. " "
Tobin Bronze Rod	16c. " "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bars in the rough, 22¼c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturers.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Not over 18 in. in width, not thinner than 23 B. S. Gauge, 2c. above price of pig tin in same quantity.

Not over 35 in. in width, not thinner than 22 B. S. Gauge, 3c. above price of pig tin.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

	Wider than..... 3in. 6in. 14in. 16in. 18in. 20in. 24in. 30in. 36in.
	and including..... 12in. 14in. 16in. 18in. 20in. 24in. 30in. 36in. 40in.
	in coils.
No. 13 and heavier	34 34 36 36 36 36 39 39 39
" 14	34 34 36 36 36 36 39 39 39
" 15	34 34 36 36 36 36 39 39 39
" 16	34 34 36 36 36 36 39 39 39
" 17	34 34 36 36 36 36 39 39 39
" 18	34 34 36 36 36 36 39 39 42
" 19	34 34 36 36 36 36 39 40 43
" 20	34 36 36 36 36 38 41 42 44
" 21	34 38 38 38 38 40 43 44 50
" 22	34 38 38 38 40 40 43 47 51
" 23	34 38 38 38 40 40 43 49 52
" 24	34 38 40 42 42 42 45 51 54
" 25	36 39 41 43 43 43 46 53 57
" 26	36 39 42 46 46 46 51 55 61
" 27	36 40 44 48 48 49 54 58 64
" 28	36 40 46 48 49 49 56 62 67
" 29	38 41 48 50 52 52 61 67 72
" 30	38 42 50 52 56 62 69 72 77
" 31	43 47 55 58 63 71 74 77 83
" 32	45 49 57 61 69 77 91 90 95
" 33	47 51 60 65 73 84 91 100 110
" 34	50 55 62 70 78 91 103 110 120
" 35	.. 65 70 80 90 100 115 125 ..
" 36	.. 80 90 100 115 120 135 .. ..
" 37	.. 104 114 129 144 159 174 .. ..
" 38	.. 124 139 154 169 184 204 .. ..
" 39	.. 144 164 184 204 224 .. .. ..
" 40	.. 174 204 224 244 .. ..

In flat rolled sheets the above prices refer to lengths between 2 and 3 feet. Prices furnished by the manufacturers for wider and narrower sheet. All columns except the first refer to flat rolled sheet. Prices are 100 lbs. or more at one time. Less quantities 5c. lb. extra. Charges made for boxing.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.
Outside Diameters. BASE PRICE, 25 Cents per Pound.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ 4in.	2 ins.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.	..	..	..	..	..	..	..	27	24	..	..	14	20	10	9	16	23
12.	.109.	..	..	..	..	..	..	..	26	..	..	..	15	..	..	..	..	..
14.	.083.	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..
16.	.065.	..	..	..	..	.	28	27	27	24	23	21	21	21	21	27	31	57
18.	.049.	..	..	..	..	33	30	29	28	25	26	26	26	..	..	..	..	..
20.	.035.	117	..	46	39	34	33	32	30	29	30	30	30	31	38	49	58	81
21.	.032.	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..
22.	.028.	158	98	48	42	38	37	35	34	..	..	45	..	..	..	..	..	..
24.	.022.	188	133	108	88	79	73	62	60	66	..	..	..	..	..	..	..	..

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

Diameter. B. & S. G'ge.	000 to No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price, per lb....	32	32½	32½	33	33½	34	34½	35	36	37	38	43	46

PRICE LIST FOR GERMAN SILVER IN SHEETS AND ROLLS.

Per cent.	Price per lb.	Per cent.	Price per lb.
12	$0.52	16	$0.58
13	.53	17	.59
14	.54	18	.60
15	.55		

These prices are for sheets and rolls over 2 inches in width, to and including 8 inches in width and to No. 20, inclusive. American or Brown & Sharpe's Gauge. Prices are for 100 lbs. or more of one size and gauge in one order. Discount 50%.

GERMAN SILVER TUBING.

4	per cent.	to No. 19,	B. & S.	Gauge, inclusive	$0.60
6	"	" 19,	"	" "	.70
9	"	" 19,	"	" "	.85
12	"	" 19,	"	" "	1.00
15	"	" 19,	"	" "	1.15
16	"	" 19,	"	" "	1.20
18	"	" 19,	"	" "	1.30

German Silver Tubing thinner than No. 19 B. & S. Gauge add same advances as for Brazed Brass Tube.

For cutting to special lengths add same advances as for Brazed Brass Tube. Discount 40%.

PRICE OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 2c. below to 6c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2c. to 3½c. above the price of bullion.

DIRECTORY

METAL ROLLING MILLS.

INGOT, PLATE, SHEET, ROD, WIRE, TUBE, METAL GOODS.

HENDRICKS BROTHERS
Manufacturers of
Sheet and Bar Copper
COPPER FIREBOX PLATES
and STAYBOLTS
WIRE and BRAZIER'S RIVETS
IMPORTERS AND DEALERS IN
INGOT COPPER, BLOCK TIN,
SPELTER, LEAD, ANTIMONY
BISMUTH, NICKEL, Etc.
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SCOVILL MFG. CO.
WATERBURY, CONN.
THE LARGEST AND MOST FULLY EQUIPPED BRASS ROLLING MILLS AND METAL GOODS MANUFACTURING ESTABLISHMENT IN THE WORLD
Estimates for Specialties in Brass, German Silver and Aluminum furnished on application. DEPOTS:
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General Offices, Mills and Factories.
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NEW YORK OFFICE, 99 JOHN STREET.
Providence (R. I.) Store, 131 Dorrance St.
Shipments Upon Receipt of Order From Large Stock of
SEAMLESS DRAWN BRASS AND COPPER TUBING
BRASS {SHEET ROD WIRE} COPPER {SHEET ROD WIRE}
AT WATERBURY GERMAN SILVER {SHEET ROD WIRE}

Non-Corrosive Finest Quality
COPPER AND YELLOW
(Muntz) Metal
Naval Brass
Naval Bronze
Manganese Bronze
Plates, Sheets, Bolts, Bars, Rods, Nails, Tacks, &c.
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NEW BEDFORD, MASS.
71 Water St., New York 61 Batterymarch St., Boston

C. G. HUSSEY & CO.
PITTSBURGH, PENNA.
Manufacturers of
COPPER
In Sheets, Plates, Rolls
ANODES
Tacks and Nails

SEAMLESS BRASS and COPPER TUBING
CONDENSER TUBING
Manganese
Aluminum
Phosphor
Silicon
BRONZE
"BRIDGEPORT" BRONZE ROD
PHONO-ELECTRIC WIRE
For Trolley, Telephone and Telegraph Lines
BRIDGEPORT BRASS CO.
Manufacturers
BRIDGEPORT, CONN.

BRASS and COPPER in Sheets and Rolls
SILVER PLATED METAL (for Coach Lamps)
BRITANNIA METAL
B. & M. BABBITT METAL for Bearings
LINING METAL for Automobile Bearings and Copper for Electrical Purposes
H. K. & F. S. BENSON
GLEN RIDGE, N. J.

THE SEYMOUR MFG. CO.
SEYMOUR, CONN.
German Silver
BRASS, COPPER and BRONZE IN SHEETS, WIRE, RODS and TUBES
COPPER AND NICKEL ANODES
Resistance Wires, Wire, Shot Copper

A. H. Wells & Co.
WATERBURY, CONN.
MANUFACTURERS OF
SEAMLESS..... NICKEL SILVER, BRASS, COPPER, BRONZE AND PURE COPPER **TUBING**
TUBING FOR ELECTRICAL PURPOSES
Odd and Special Shapes, and Small Tubing, a Specialty
—ALSO THE—
Bourdon Steam Gauge Springs
All sizes from 8 to 36, B. & S. Gauge.

The Ansonia Brass and Copper Co.
99 JOHN ST., NEW YORK
MANUFACTURERS OF
BRASS and COPPER Sheets, Tubes, Rods and Wire
SOLE MANUFACTURERS TOBIN BRONZE
(Trade-Mark Registered)

PHENIX TUBE CO.
Manufacturers of
Brass and Bronze Iron Lined Tubes
Brazed Steel Tubes,
Round and Square.
Main Office and Mills: Brooklyn, N. Y. City Branch Offices: Chicago, San Francisco

THIS SPACE FOR SALE
SEND FOR RATES

"RIVERSIDE" German Silver Phosphor Bronze
Sheets, Rods, Wire, Ingots, Castings, Jewelers' Bars and Alloys
The Riverside Metal Co.
Riverside, Burlington Co., N. J.

SPECIAL SHAPES
Wire Drawing, Tinning, Slitting
in
BRASS, BRONZE, COPPER, STEEL, ALUMINUM, GERMAN SILVER AND SPECIAL ALLOYS.
THE ELECTRICAL ALLOY CO., Morristown, N. J.

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DIRECTORY

METAL ROLLING MILLS.

INGOT, PLATE, SHEET, ROD, WIRE, TUBE, METAL GOODS.

SEAMLESS STEEL TUBING
From 4 in. Diameter to 1-64 in.
Finished Bright, Smooth and Accurate to 1-1000 In. Inside and Out
Tool Steel Tubing. Soft Steel Tubing. Also Small Brass, Copper and Aluminum Tubing.
ELLWOOD IVINS TUBE WORKS
Oak Lane Station, Philadelphia, Pa.

Wm. F. Renziehausen Co.
Rollers of Silver Anodes and Sterling Silver
ALSO DEALERS IN
FINE GOLD AND SILVER
43-47 Oliver St., Newark, N.J.
Long Distance Phone 3759 R.

LINTON & CO.
95 PINE STREET PROVIDENCE, R. I.
MANUFACTURERS OF
SEAMLESS BRASS .. TUBING
In Small Sizes
GOLD SOLDER, sheet or wire.
SILVER SOLDER, sheet or wire.
SHEET BRASS SOLDER

ROLLED FIRELESS STERLING SILVER
SILVER SOLDERS, ANODE SILVER and SILVER WIRE
For further information address
JOHN J. JACKSON CO.
91 Mechanic St. NEWARK, N. J.

THIS SPACE FOR SALE
SEND FOR RATES

THE PILLING BRASS CO.
WATERBURY, - - CONN.
Manufacturers of
Rolled Brass, Bronze, German Silver and Copper in Thin Gauges, Platers' Metal

THIS SPACE FOR SALE
SEND FOR RATES

Established 1859. Telephone connection.
JOHN TOOTHILL
BRITANNIA METAL. ANTIMONIAL LEAD.
SHEET BLOCK TIN
CASTING, ROLLING AND REFINING.
85 Barclay St., New York City
ROCHELLE PARK, N. J.

THIS SPACE FOR SALE
SEND FOR RATES

Britannia Metal *CASTING, ROLLING and REFINING FOR THE TRADE.*

STANDARD ROLLING MILLS
363 HUDSON AVENUE, BROOKLYN, N. Y.

DIRECTORY

MANUFACTURERS OF PLATED SHEET METALS SHEET METAL AND WIRE GOODS

THIS SPACE FOR SALE
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NATIONAL SHEET METAL CO.
Manufacturers of
PLATED SHEET METALS
FANCY ROLLED METALS
Nickelzinc, Brasszinc, Copperzinc, Bronzezinc, Nickeltin, Brasstin, Coppertin, Bronzetin Sheet Zinc, polished and unpolished, for stamping.
Large Saving to Manufacturers Last Year's Sales 1,000,000 lbs.
For Further Information Address Office: PERU, ILLINOIS

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BUCKLE TONGUES
made from any metal desired.
English style. The finest made.
THE CAMPBELL-WARNER CO., Middletown, Conn.

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PIG LEAD, SPELTER, SHEET ZINC AND ROD, ACIDS

Matthiessen & Hegeler Zinc Co.
LA SALLE, ILLINOIS
Smelters of Spelter
and Manufacturers of
Sheet Zinc and Sulphuric Acid
Zincs for Leclanche Battery
Special Sizes of Zinc to order. Rolled Battery Plates. Selected Plates for Etchers' and Lithographers' use. Selected Sheets for Paper and Card Makers' use. Stove and Washboard Blanks.

Horsehead Spelter
The Original Brand of Pure Spelter
Indispensable in the manufacture of
Cartridge Metal, German Silver, Fine Spun Work, Fine Castings, Superior Alloys, &c.
THE NEW JERSEY ZINC CO.
National City Bank Bldg.
55 Wall Street, New York

ILLINOIS ZINC COMPANY
Manufacturers of
Spelter, Sheet Zinc, and Sulphuric Acid
PERU, ILL.
W. FISHER, Agent, 81 and 83 Fulton St., New York City
Telephone, 139 Beekman

High Grade Spelter
GOLDEN ROD BRAND
Suitable for High Grade Brass Work, Cartridge Metal, Etc.
ALUMINUM ALLOYS, Etc.
Brazing Solder
H. M. Shimer & Co.
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Sandoval Zinc Co.
Manufacturers of
HIGH GRADE
SPELTER
SUITABLE FOR ALL PURPOSES
General Offices:
120 N. Peoria Street, Chicago, Ills.
Works: Sandoval, Ills.

Cold Rolled Zinc
IN COILS FOR
Drawing and Stamping
THE PLATT BROS. & CO.
WATERBURY, CT.

THIS SPACE FOR SALE

High-Grade Spelter and Sulphuric Acid
HEGELER BROTHERS, DANVILLE, ILL.

THIS SPACE FOR SALE
SEND FOR RATES

METAL SMELTERS, REFINERS, DEALERS.
BUYERS AND SELLERS OF NEW AND OLD METALS.

Illinois Smelting & Refining Co.
122 N. Peoria Street, Chicago, Ill. Cable Address "Smelref," Chicago
Manufacturers of
Pig and Bar Lead, Spelter, Babbitt Metals
Linotype, Stereotype, Monotype and Electrotype Metal, Yellow Composition and Phosphor Ingots
Dealers in New and Old Metals, and the Largest Buyers of Zinc Dross, Skimmings, Sal Skimmings, Scrap Zinc and Aluminum

THE MORTON B. SMITH CO.
241 and 243 Front St., New York
Offer for Sale:
HEAVY COPPER AND WIRE
Ready for the Crucible
COMPOSITION
Carefully Selected
HEAVY YELLOW BRASS
Free from Iron
OLD METALS GENERALLY

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